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Journal of Indian botany.

Madras :Methodist Pub. House,1919-1923.

<https://www.biodiversitylibrary.org/bibliography/9050>

1-2, 1919-1921: <https://www.biodiversitylibrary.org/item/37219>

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THE INDIAN SPECIES OF ERIOCAULON *

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The investigation of the Indian Species of *Eriocaulon* on which the following account is written arose out of the difficulty found in determining some of my own collections in South India, which led me to examine the collections in the herbaria of the Royal Botanic Gardens, Calcutta, and at the Agricultural Station, Coimbatore (Madras), and subsequently in those of the Peradiniya Gardens, Ceylon, the Forest College, Dehra Dun, and the Agricultural College, Poona, for types not found in the two former.

From an examination of the sheets in the Calcutta herbarium it was soon clear that other collectors besides myself have found the identification of species difficult. As far as India is concerned there are, if we exclude local Floras which have largely followed the F.B.I., only two works in which descriptions of the species are given: Hooker's *FLORA OF BRITISH INDIA*, Vol. VI, (1894) and Ruhland's monograph in Engler's *DAS PALANZENREICH* (1903). The former of these is naturally now incomplete, being without species which have been founded since its date. The latter is not available to the ordinary botanist, and even if it were is, since it contains all the species of the world, too cumbersome for the collector. It is therefore thought that a revision of the Indian species accompanied by illustrations would perhaps be welcomed by collectors of this interesting but difficult genus.

It may not be out of place in this connection to note that the identification of a species from its published description alone is nearly always fraught with some, often with very grave risk of error; and that only by reference to the actual type sheet can certainty be attained. None of the species of this genus were, as far as I know, founded in this country, so that the actual specimens from which they were described are not here but in Europe. We have however in this country duplicates of many of the type sheets, and though the possibility of

* This paper was accepted by the editor of the Records of the Botanical Survey of India in September, 1918, but owing to congestion of work for that periodical is by his permission now printed here. A preliminary abstract appeared in this Journal, Vol. I, p. 49.

error in the duplicates is not excluded, it is not unreasonable to accept them as identical with the types. Kurz made, certainly, on a sheet in the Calcutta herbarium a note to the effect that the label must be wrong and that most of them seem to be wrong, but the latter part of the remark appears to me unduly pessimistic for with most of the sheets there is strong internal evidence of their correctness. There are however some species which I have not been able to trace, especially those founded by Ruhland, the types of which are presumably in Berlin. While therefore there are several forms which appear to be new species, they may not be so in reality. My new species are therefore advanced tentatively and with the object of avoiding the confusion which would inevitably follow a mistaken identification.

The illustrations given herein are mainly from photographs of herbarium sheets, and wherever possible, of the actual types or co-types of the species. It is hoped that this will make identification easier and more confident.

In the descriptive portion I shall as a rule give references to the Flora of British India and Ruhland's monograph only, and shall omit all synonyms, since the ordinary collector does not need them. But for reference in herbaria I shall give in Appendix II the identification marks and previous namings of all the sheets seen by me (practically all those in India and Ceylon) under the true species-name, as believed by me, and those interested will find the synonyms there. The usual enumeration of the collectors and their marks, in connection with the distribution of each species, is (with this appendix) unnecessary and has been omitted.

Following the name and the references, I refer (in the usual place) to the type sheet or its duplicate whenever I have seen this. If the type has not been seen no reference is made as a rule to any sheet. My authority for the name will be found in the appendix.

I tender my most grateful thanks to Lt.-Col. Gage, I.M.S., at the Royal Botanic Gardens, Calcutta; to Rao Bahadur K. Rangachariar of Coimbatore; to Dr. Burns and Mr. R. K. Bhide of the Agricultural College, Poona; to Mr. R. S. Hole of the Forest College, Dehra Dun, and to the Dr. Petch of Ceylon for very kindly lending me all the collections under their charge for examination; and to Col. Gage in addition for lending me reference books. I am the more indebted to them since on account of military duties my work was so often and lengthily interrupted that I had to keep the sheets far longer than I had expected, the work being begun in the autumn of 1917. To Mr. Streenivasiah, my herbarium-keeper, I am also gratefully indebted for much assistance, and he prepared nearly all the photographs.

Introduction.

The ERIOCAULACEÆ are a very distinct family of flowering plants which in one respect occupies among the Monocotyledons a position analagous to that of the COMPOSITÆ among the Dicotyledons. The flowers are very small and aggregated into a head, which is enclosed at first and subsequently backed by a involucre of outer bracts. Unlike the COMPOSITÆ the flowers are unisexual, and are typically complete in every other respect, that is they possess complete whorls of sepals and petals, and either two of stamens or one of carpels. The genus *Eriocaulon* with its three sepals, three petals, and three carpels in the female flower; and 3 sepals usually united into a spathe-like calyx, a trumpet-shaped 3-lobed corolla and 6 stamens in the male, comes nearest to the monocotyledonous type: but we find two-merous flowers in some species; and in some, otherwise trimerous, two sepals only, or two or fewer petals, obviously by reduction.

The genus was founded by Linnaeus in 1742, and subsequently placed by Kunth along with one or two related genera as a tribe of the order RESTIACEÆ. Martius, reviewing this tribe in 1835, raised it to the rank of a distinct order, the *Eriocaulonaceæ*, a name afterwards changed by Richard to ERIOCAULACEÆ. Koerniche wrote a monograph with very full descriptions and several new species in 1856.* Steudel gave short descriptions of all the known species in his *Syn. Pl. Cyperacearum* in 1858 and other authors, notably Sir J. D. Hooker, have founded species in "Floras" of Ceylon, India, Tropical Africa and Brazil. In 1903 there appeared in Engler's *Das Pflanzenreich* a monograph by Ruhland of all the species known in the family, with several new ones founded by him. The number of species described was 420, of which 200 belonged to *Paepalanthus* found only in America, and 193 to *Eriocaulon*. The latter genus is distributed all over the warmer parts of the world, being found in America, Africa, Asia and Australia, and even in Europe as far west as Ireland. But although there are in India some fifty species, occurring over the whole of South India as far North as Mount Aboo and the Central Provinces, and along the Himalayas from the eastern end to Dehra Dun, there are no collections from the United Provinces or the Punjab. In India therefore excluding the Himalayas, the genus is confined to the tropics.

Most species of *Eriocaulon* grow exclusively in wet places, a few only fully submerged, and only one or two I believe in ground always dry enough to be firm. It has long been recognised that the conditions of water and marsh are much more uniform the world over

* *Linnaea*, Vol. XXVII.

than those of dry ground ; and it is therefore not surprising that there is a sameness about the vegetative parts which we do not find in dry land plants. Thus in *Eriocaulon* the stem is nearly always very short, little more than a flat disc, with the leaves all radical and narrow, and the flower-heads are carried well above the ground or the water-level on tall scapes. There are of course differences ; submerged species have linear leaves, and some have elongate stems ; some land species are hairy, most glabrous ; in some species there is only one, in most there are numerous scapes : but except for these the differences are mostly small and difficult to define. This sameness in the vegetative parts is accompanied by a surprising amount of difference in the floral, on which therefore the separation of the species is of necessity largely based. But since the parts are always very small and need a good lens for their study the species are difficult to diagnose, and in most cases it is impossible to do so with the naked eye without considerable practice. Collecting therefore, for any one not thoroughly conversant with the species, is like pulling things out of a bran-tub, one cannot tell at once what one has got ; and the determination of the species afterwards, unless the descriptions are very clear and to the point, is difficult in the extreme. This is borne out by an examination of the material in the Indian Herbaria. Thus six collections made by Meebold in Mysore and Coorg, from September 1897 to November 1898, of what is certainly one species, were named by him, *E. sexangulare* three times, *E. truncatum* twice and *E. trilobum* once. Yet these three species should never be confused, and the plants collected did not as a matter of fact belong to any one of them. The name *E. sexangulare* I find wrongly given on 15 collectings in the Herbarium of the Royal Botanic Gardens, Calcutta, belonging to seven species quite distinct from the true *E. sexangulare* of Linnaeus ; and *E. luzulaefolium* to 13 collectings belonging to six species, four of them being among the seven just referred to ; and these are not exceptional cases ; the third column of the Appendix will show that 2 species have each been given names of 7 other species, 2 more names of 6 other species, 7 of 3 or more other species.

One result of this is that species have been given a wider distribution than they are entitled to, and this has of course led many a collector to suppose that he may have a species which really does not exist in his area. Especially is this the case with *E. luzulaefolium* Linn. which has been reported as all over South India, from Khasia to Bombay, Madras, Malabar and Ceylon. But, unless the sheets which bear Wallich's number in the Calcutta Herbarium do so wrongly, the species is confined to Nepal, Assam, Bengal and Upper Burma.

The Arrangement of the Species.

As far as the Indian species are concerned, if we except the local floras founded on the F.B.I. there are, as stated above, only two modern works giving descriptions, the F.B.I. and Ruhland's monograph of the whole family. Previous to this excellent descriptions were given by Steudel (Syn. Pl. Cyperacearum 1858) and Koerniche (Linnæa XXVII, 1854, pp. 577-692).

The species are arranged in these two works on entirely different plans. Hooker after separating the purely aquatic and submerged forms, divided the remainder according to the external appearance of the heads and the presence or absence of hairs on the receptacle. Ruhland on the other hand arranged the species according to the number of parts in the flower, placing in his first section, which though he does not so identify it I take to be *NAYSMITHIA* Huds., those with 2 parts to each whorl, in his second section those with 3 parts, and in his third those with 3 parts in the staminal and carpellary whorls but with fewer sepals or petals; these sections being further divided for convenience into the eastern or old-world species and the western or new-world. He then took the nature of the stem whether disciform or elongated, with such characters of the flower as white or black anthers, crested or plain sepals, for the lesser divisions. The difference in the two systems is very great. Two plants classed by Hooker as dimerous and trimerous varieties of the same species, *E. sexangulare*, appear in Ruhland's monograph, as also in Steudel's Syn. Pl. Cyp., in different main divisions of the old world species, and in the former's list as numbers 25 and 186 respectively. The plant named by Trimen *E. atratum* Koerniche var. *major* was raised by Hooker to the rank of a species, *E. caulescens*, and placed next to *E. robustum* Steud. of the Nilgiris, from which it hardly differs except in having a tall and branched stem; whereas Ruhland separated the two by no fewer than twelve Indian species, and placed *E. robustum* next to *E. quinqueangulare* Linn., which in Hooker's arrangement is separated from it by almost the whole of the Indian forms, one being No. 4 and the other No. 35 out of 43.

It would probably be correct to state that except in his main divisions Ruhland in fact did not attempt to arrange the species in phylogenetic groups, but only to provide a general clavis for aid in their identification. Hooker made tentative groupings, but apart from the separation of aquatic from terrestrial species made no definite sections.

Before attempting to classify the species of a genus it is clearly necessary to determine what characters if any are liable to vary with age or with the conditions of the environment, and further

to estimate if possible the relative importance from the phylogenetic stand-point of the more stable characters.

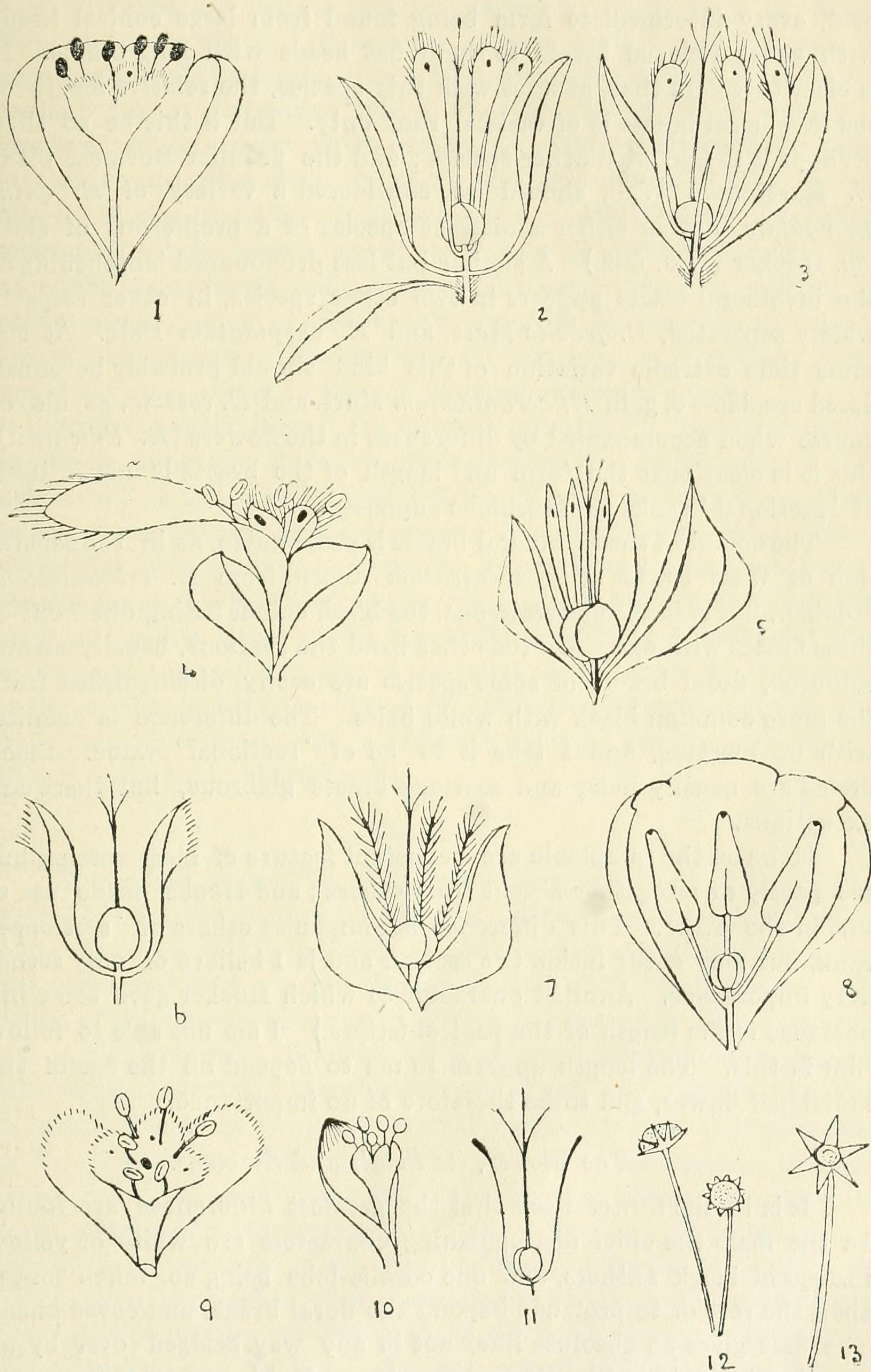
Stem and Leaf.

As said above since practically all the *Eriocaulons* grow either in swampy ground or submerged in water the stem and leaves of any one species vary but little, even in size. At the same time all submerged forms are for a like reason so alike among themselves, and the swamp forms also among themselves, that such differences as exist are of little use in separating the species. The difference between the usual disc-like stem, and an elongate branching one, which Ruhland following Koerniche used almost at the fore-front of his clavis of old-world species, though at first sight it may seem very definite, is not always a hard and fast line, and is in any case probably bound up with the robustness of the species and the nature of its habitat. As instance the Nilgiri *E. robustum* and the Ceylon *E. caulescens* referred to just above. But I have found the former with root-stock over an inch in length, and poorer specimens with leaves narrow enough to be indistinguishable from those of the Ceylon plant. In Ruhland's list one is No. 74, the other No. 120.

The Head and its Involucre.

As regards the heads Koerniche used the difference of hairy and glabrous involucre, as also did Hooker and Ruhland; and without doubt this character is of sectional value. But I find the hairiness varies and may even be absent from a plant undoubtedly for other reasons allied to hairy species. This character must not therefore be used too rigidly, as in Ruhland's wide separation on this account of *E. Brownianum* Mart. from *E. nilagirens* Steud. (Nos. 93 & 117 respectively.) The specimens in Herb. Calc. show plainly that the type sheet of the former is of a not fully undeveloped plant and that the absence of hairs is here accidental.

Characters which give very distinctive appearance to the head and would certainly appear at first sight of at least *specific* value are afforded by the form and length of the involucre bracts. Thus they are horizontal and very obtuse and slightly turned up at the end in *E. sexangulare*, *E. luzulaefolium*, *E. truncatum* and *E. Thwaitesii*; they are acute and ultimately reflexed in *E. quinquangulare* and *E. trilobum*. In *E. xeranthemum*, *E. roseum*, *E. martianum* Wall. and forms of *E. Dianae* collected in Coorg, they are very much longer than the head, projecting beyond the general margin like the rays of a sun-flower. (Pl. fig. 12 & 13.) Koerniche placed great value on this. But a comparison of a large number of collections made on the Western Ghats from Salsette to Calicut, all with the same flower,



TYPES OF FLOWER.

show that the last named species is extremely variable in this respect, every intermediate form being found from large conical heads with short reflexed bracts to small flat heads with long bracts. It is clear therefore that, at least with this species, the relative length of the involucral bracts is of varietal rank only. But if this be so then perhaps it is also with other species; and the peculiar Burmese plant *E. Martianum* Wall. should be considered a variety of *E. quin-guangularis*, not as either a distinct species or a proliferous of state (*cp.* Hooker (1) p. 582.) A similar but less pronounced lengthening of the involucral tracts appears in two other species, in other respects widely separated, *E. gracile* Mart. and *E. cuspidatum* Dalz. At the same time extreme variation of this kind should probably be considered specific—e. g. in *E. xeranthenum* Mart. and *E. roseum*, as also of course when accompanied by differences in the flowers (*E. Edwardii*). But it is clear that the form and length of the bracts is not in itself of 'sectional' ranks as Koerniche supposed.

The colour of the involucral bracts is some guide, as in the separation of what I take to be *E. atratum* Koern. from *E. subcaulescens* Hook. f., but it is an uncertain one, the black colour fading often out of these bracts with age. On the other hand the scarious, usually straw-coloured, floral bracts of some species are easily distinguished from the more common black with white hairs. The difference is definite, with no merging, and I take it to be of 'sectional' value. Black bracts are usually hairy and scarious bracts glabrous, but there are exceptions.

Hairs on the receptacle are a constant feature of most species, but are partly or altogether absent from others; and Hooker made use of this in the F.B.I. This difference accompanies others of 'sectional' rank, but may occur inside the section and is I believe of only secondary importance. Another character to which Hooker gave some importance is the length of the pedicel (stipes.) I am not able to follow him in this. The length appears to me to depend on the age of the individual flower, and to be therefore of no importance.

The Flower, its Petals and Stamens.

It is in the flower itself that the greatest differences are found. In the male the chief distinguishing characters are white or yellow instead of black anthers, and one corolla-lobe being so much longer than the rest or to protrude beyond the floral bracts and cover them. The first gives an absolute line, not in any way bridged over by an occasional species with olive-green colour. Ruhland stated (*lc.* p. 16) that the colour is constant in the species, but used this difference more than once in his clavis as if of only minor importance. Hooker

did not notice it at all. Steudel and Koerniche were both aware of this difference, but neither paid any particular attention to it. Apart from the improbability of so very definite a change as the loss or acquirement of the black colour happening more than once, yellow anthers are so distinctive that I have no hesitation in making a 'section' of the species which possess it. The protruding male petal is also a very distinctive character and one naturally used in any scheme of classification. It appears to be a very constant character, and nearly all the species which show it do so quite definitely. But as might be supposed indications of the habit are not wanting in other species, some of which may therefore be regarded as on the line of development. The stamens do not vary in number. They are always six, except in the one dimerous-flowered species.

In the female flower the ovary is invariably 3-lobed (except of course in dimerous flowered species)—there is no reduction. The petals are 3 or 2, and only slight differences occur between those of different species; except in one direction. As a rule they are oblanceolate, with thick terminal hairs and slender, longer, lateral ones; but in some species there is a brush of slender filaments or hairs, which might be regarded as due either to the longitudinal splitting of the petal into many parts or to a narrowing of the petal accompanied by an increase in the number and length of the basal hairs. This latter change may well have come more than once, in different groups, I therefore do not use it as a 'sectional' characteristic.

The Sepals.

The sepals shows the most interesting variation. The simplest probably primitive, form is boat-shaped, black in colour and with a few hairs along the mid-rib or keel. In one Himalayan species the sepals are connected into a calyx similar to that of the male flower. The petals of this species differ from others in having the gland terminal and in being clawed. Ruhland has a group of Chino-Japanese species with these character, I therefore found my section CONNATO-SEPALAE to include them. In all other species the sepals are free. A development of the boat-shaped sepal is the formation of an enlargement (a thickening, wing, or crest) along the keel. In some species this takes the form merely of a thickening (*E. Thomasi* Pl. I. fig. 7) in others of a narrow wing or crest which may be lobed, or pectinate (figs. 5 & 6.) The depth of the thickening or crest appears to vary in the same species but there is usually no doubt about the crest when it is present. I therefore make a 'section' of those species which possess this enlargement, whatever its precise form may be. Here again it may be that *E. sexangulare*, *E. cuspidatum* and *E. Thomasi*, are not derived

from the same proximate stock as *E. Elenorae*, *E. Margaretæ*, and *E. minutum*, through all show this character. The question could be decided only after examination of extra-Indian species.

These three types of sepal : the united, the boat-shaped and the crested, are quite distinct ; the only specific difference being that in the latter two the three sepals may not be equal in size, and one may be flat instead of boat-shaped, or without the crest. But in the species which show these exceptions individual variation does occur. Thus in *E. Elenorae* the relative sizes of the 3 crested sepals varies, two may be of a size, one smaller, or the three all unequal, or one the smallest without a crest. These variations are shown in plants otherwise indistinguishable. They are therefore not of specific value. I am doubtful indeed whether *E. Elenorae* where the sepals are unequal should really be separated from *E. Margaretæ* (were they all alike), but the species are slightly different in appearance, and I have found no variation in plants with the 3 sepals equal (*E. Margaretæ*). So also in those with two sepals boat-shaped, one not. The odd sepal in *E. Dianæ* may be lanceolate and as long as the other two, or shorter and bristle-like, or so slender that it is difficult to see.

We have in both these lines apparently a reduction in the size of one sepal till it nearly disappears, and if this be so a species with only two sepals may be derived from one with three. An instance where this has actually and unmistakably occurred even inside the species is afforded by *E. Xeranthemum* Mart. Hooker in F.B.I. gives the female sepals as 2. I find plants on the Himalayas have 2 sepals, but some at least on the Malabar coast have 3. Ruhland says that the sepals are 3, unequal. No one seeing the plants would wish to make several species of them. The same occurs in *E. truncatum* where the sepals may be 3, but are usually 2 only, and in the same plant I have found 3 equal, 2 and 1 smaller and 2 only ; and also in *E. Thwaitesii* Hook. f.

We are thus faced by a set of conditions which must be unique among flowering plants. No other case is known to me of a reduction in the relative number of sepals and petals within the species of genus, though the number may be indefinite—e.g. in species of *Ranunculus* and *Jasminum*. The stamens certainly show a reduction in some genera (e.g. *Cassia* and *Bauhinia*), and occasionally between the genera of family (e.g. Caryophyllaceae, Acanthaceae), but even this is not common. Characters in fact which in all other phanerogamic families are so constant as to be of the first importance in determining families and cohorts here vary even within the species, and so are of no use at all as guides to the phylogeny.

The Sections or Main Groups.

The following deviations from what might be called the normal or primitive conditions seem to be the most constant—hairy involucre, one male petal enlarged, scarious floral bracts, crested female sepals, united female sepals, and white anthers; while the number of sepals or petals, in either sex, their relative sizes and shapes, the length of the involucral bracts and of the pedicels are not necessarily even of specific rank.

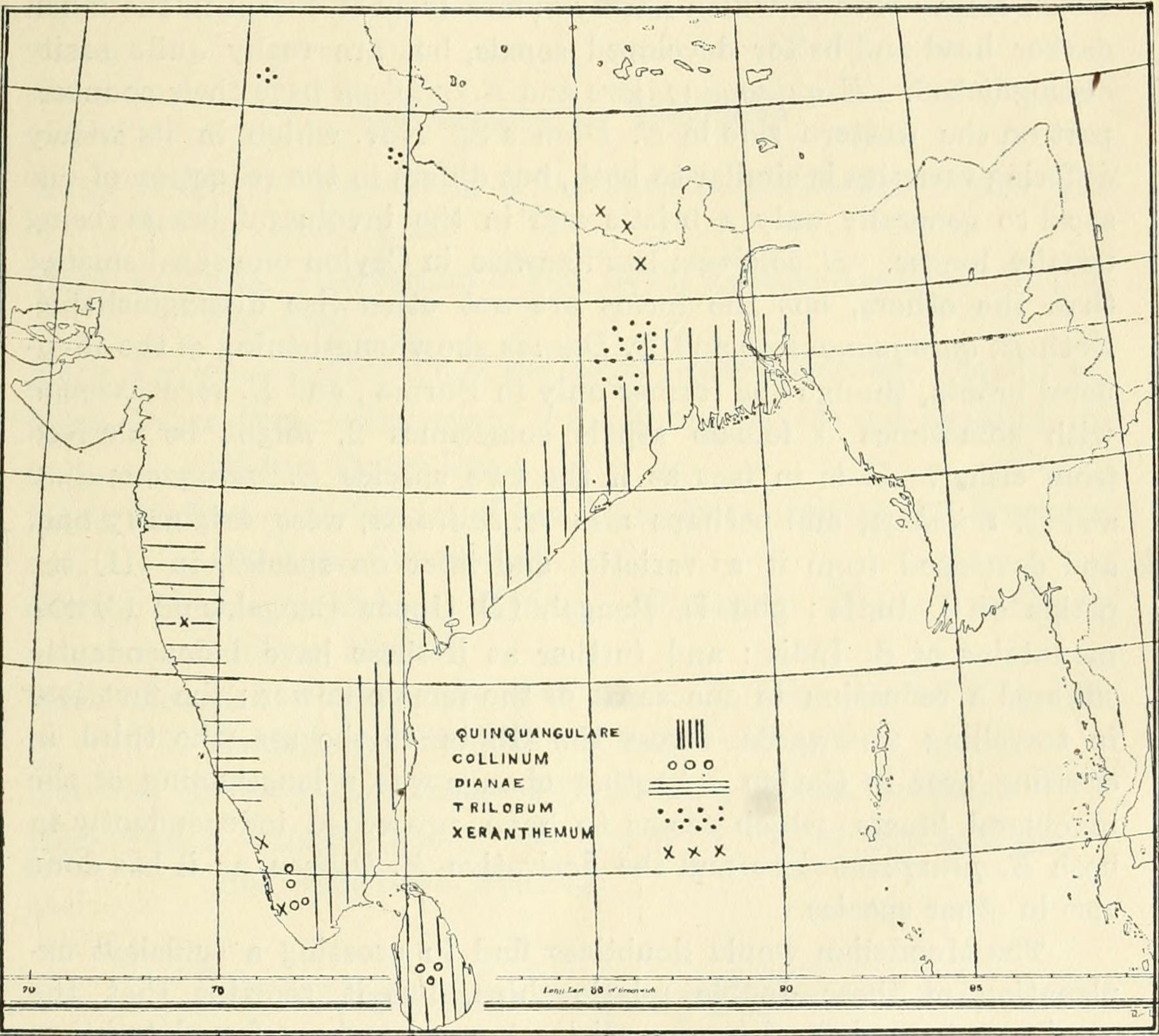
If this supposition be correct, and the evidence is I think too strong to doubt it, the Indian species fall naturally into eight groups distinguished by the above 'sectional' characteristics, with a ninth composed of species or forms which grow wholly submerged in water and have elongated stems thickly covered for several inches with long capillary leaves. This group I name SETACEÆ, from the chief and Linnaean species; not, following Hooker, *Aquaticae*, because there are other species with just as good a claim to that title. A character which like this is purely adaptative is not as a rule considered of much value in determining relationships, but the five forms which share this in common are so alike among themselves and so different in appearance from any other species that they must go together in any systematic scheme. The possibility is not excluded that they have sprung severally from the other distinct sections of the genus, but the fact that the male sepals are more or less free instead of being united into a calyx split at the back as with most of the other species, may indicate that they separated off early from the primitive stock. Of my other eight sections the ANISO-PETALÆ with one male petal much enlarged, and the HIRSUTÆ with hairy involucre, correspond in part to groups in the F.B.I. of species with these characters but not so named. The LEUCANTHERÆ with white or pale yellow anthers, the CRISTATO-SEPALÆ with crested female sepals and the CONNATO-SEPALÆ with the female sepals connate, found places in Ruhland's arrangement; but, except the last of which there is only one species in India, were broken up in the different claves and included several species which I exclude. The SCARIOSÆ with scarious floral bracts is I believe a new grouping; and I place together as SIMPLICES all species which do not show one or other of the above mentioned characters.

Geographical Distribution.

The geographical distribution of the species and groups presents many interesting problems of variation and relationship. As regards the extra-Indian species, the material at my disposal does

not allow me to say very much; but certain general conclusions may be drawn from an examination of the very full and careful descriptions of the flowers given by Ruhland in his monograph. It might be supposed at the outset that since the plants grow in water and marshy ground their seeds would be carried on the feet of migrating birds, and that this, coupled with the universally accepted similarity of the conditions of water and marsh the world over, would result in a very wide distribution of most of the species. Some certainly are scattered widely, but the majority seem to be confined to comparatively small areas. This question is of course bound up with that of the limits of the species: thus *E. Sieboldianum* Sieb et Zucc, as understood by Hooker in the F.B.I., occurs all over S. E. Asia from Bombay to Japan and N. Australia; but Ruhland separating from it several smaller species gives to them a much narrower distribution, though he retains almost as wide a one for *E. Sieboldianum* itself. Of the groups which I have proposed in this account the SETACEÆ group has one representative, *E. bifistulosum* Van Huerck, in West Africa and probably others elsewhere. The SIMPLICES being all those with no special modification of the floral parts are no doubt primitive and world-wide. The HIRSUTÆ and ANISOPETALÆ are spread over S. Eastern Asia from Cochin to China, probably on the mountains of the warmer parts, and the latter seem to have a second centre of distribution in British Guiana. The CRISTATO-SEPALÆ also seem to have a centre in tropical South America, reaching from Mexico to Brazil. But the CONNATO-SEPALÆ, which have in India only one representative on the Himalayas, belong almost entirely to China and Japan. Of the LEUCANTHERÆ one species, *E. Sieboldianum* Sieb. et Zucc, is widely spread over tropical S. E. Asia, Malaya and Australia, but the others seem confined to India. *E. Sieboldianum* is probably the most widely distributed of all the species, and *E. Brownianum* Mart. with its varieties (or related species of Ruhland) covers almost as wide an area.

Inside India there appear to be on the plains and lower hills no species at all north of a line from Mt. Aboo to Dacca, and not many northwards on the Himalayas, though there are one or two in Kashmir. They occur all over South India. The HIRSUTÆ belong almost entirely to the mountains above 3,000 ft. of Burma, Bengal, S. India and Ceylon, but extend far southwards to Singapore. The ANISOPETALÆ are developed chiefly in Ceylon, with one species in Bengal, one in the Central Provinces and the Deccan and another on the Nilgiris; but not curiously enough collected hitherto on the Palnis which are nearer Ceylon and floristically show closer affinities. Of the CRISTATO-SEPALÆ the smaller species belong to the Western



Map 1. Showing the distribution in India of certain species of the section *Simplicis*.

Mountains from Mt. Aboo to Coorg, but do not go further north, east or south.

The group *collinum-quinquangulare-trilobum-Dianae*, has collectively the widest distribution, and shows very interesting developments and cross-relationships. *E. quinquangulare* belongs to the plains of Ceylon, S. India and the Deccan, extending only rarely to the Western side in Canara. On the mountains to the south it is replaced by *E. collinum* Hook. f. and to the north in Bengal by *E. trilobum* Ham., both of which hardly differs from it except in the much darker head and better developed sepals, but are really quite easily distinguished. *E. quinquangulare* and *E. trilobum* have their counterpart on the western side in *E. Dianae* Sp. Nov. which in its widely differing varieties is similar to both, but differs in the reduction of one sepal to generally only a bristle and in the involucral bracts being usually longer. *E. collinum* has likewise in Ceylon one sepal smaller than the others, but the forms are not otherwise distinguishable. Both *E. quinquangulare* and *E. Dianae* show lengthening of the involucral bracts, though the former only in Burma; and *E. xeranthemum* with sometimes 3 female sepals sometimes 2, might be derived from either. It is in fact as if the two species *E. quinquangulare* and *E. trilobum*, and perhaps also *E. collinum*, were originally one, and developed from it as varieties and later on species, in—(1) the plains of S. India: and L. Bengal, (2) Upper Bengal, and (3) the mountains of S. India: and further as if these have independantly suffered a reduction in one sepal of the female flower; the first two in travelling westwards across the Ghats to the sea, the third in crossing over to Ceylon. Another change was a lengthening of the involucral bracts, which seems to have proceeded independently in both *E. quinquangulare* and the derivative *E. Dianae*, as it has done also in other species.

The Mendelian would doubtless find in crossing a sufficient explanation of these double relationships, but it remains that the species as here defined occupy distinct areas and are found together if at all only on the borders of contiguous fields.

Reference to published Works.

F.B.I.—Flora of British India, by J. D. Hooker. Volume; VI, (1894) pages quoted in Arabic numerals: a species number given thus, No. 3.

Ruhl,—Die Eriocaulaceae by W. Ruhland in Engler's Das Pflanzenreich (1903). The serial number of the species alone is quoted.

Fl. Ceylon.—Handbook to the flora of Ceylon by Trimen and Hooker Vol. V (1900).

Cooke Fl. Bomb.—The Flora of Bombay by Cooke, Volume and page in Roman and arabic numerals respectively.

Fyson Fl. N. & P. H. T.—The Flora of the Nilgiri and Pulney Hill tops by P. F. Fyson. (Madras 1915—21). 3 Vols.

Koern. Linn.—Koerniche in Linnaea Vol. XXVII (1854), pp. 577-592.

Steud. Cyp.—Steudel in Syn. Plantarum Cyperacearum (1858).

References to Herbaria.

Herb. Bombay.—Herbarium of the Agricultural College, Poona, now at Ganeishkind.

Herb. Calcutta.—Herbarium of the Royal Botanic Gardens, Sibpur, Calcutta.

Herb. Ceylon.—Herbarium of the Royal Botanic Gardens, Peradiniya.

Herb. Dehra Dun.—Herbarium of the Forest College and Research Institute, Dehra Dun.

Herb. Madras.—Herbarium of the Agricultural College and Research Institute, Coimbatore.

Herb. Presidency College, Madras.—Herbarium of the Presidency College, Madras.

Herb. Sedgwick.—Herbarium of Messrs L. J. Sedgwick, I.C.S. and T. R. Bell, now St. Xavier's Coll., Bombay.

Herb. St. Xavier.—Herbarium of St. Xavier's College, Bombay.

Herb. Talbot.—Herbarium of the late W. A. Talbot now at Ganeshkind with Herb. Bombay.

Terms used in descriptions.

Pale*—of the involucre or the floral bracts,—an absence of black, usually resulting in the bracts being straw-coloured when dry, but sometimes light-brown, sometimes white. When fresh they are in some, perhaps in all cases, scarious and translucent.

* The word pale may appear hardly suitable as a descriptive term, but I know no other that fits the case so well. For the bracts so termed are characterised not by the presence of a light coloured pigment, so that they cannot truly be called white or yellow, but by the absence of the more usual black; and being thin are translucent, but when dry straw-coloured.

Normal—of the flower—Sepals in the male united into a calyx split at the back; in the female 3, equal and similar. Corolla of male trumpet-shaped with 3 lobes; of female 3 oblanceolate free petals. Stamens 6, anthers black. Ovary 3 celled.

Eriocaulon Linn.

Linn. Gen. Ed. II 35 (1743).

Scapigerous herbs, aquatic or on marshy, rarely dry ground. Stem usually very short and disci-form, but in some species elongate and branched. Leaves narrow. Scape slender, with 4 to 7 ribs, twisted usually, and enclosed at the base in a sheath with oblique mouth. Flowers minute, each² in the axil of a bract, in involucrate heads; unisexual, nearly always monoecious; perianth inferior. Male flower:—Sepals 2 or 3, usually, but not always, connate into a calyx split on the ad-axial side. Corolla mono-petalous, funnel-shaped; lobes 3, small, usually ciliate and each with a large black gland. Stamens 6, attached to the corolla; anthers black or pale yellow. Female Flower:—Sepals 2 or 3 flat, boat-shaped or crested, equal or unequal. Petals 3 to 0 free, linear, oblanceolate or spathulate, ciliate, each with a black gland near the upper margin. Ovary three-celled; style with 3 short branches. Carpels in fruit globose opening down the back to let out the one seed. Seeds translucent yellowish or brown, often with darker markings. Embryo minute, outside the horny endosperm.

Species about 190 in the tropics and rarely in temperate regions.

The above diagnosis is for the normal 3-merous flower. In one Indian species, the flowers may be dimerous with 4 stamens or a 2-celled ovary. But in the majority of species there are 6 stamens or a 3-celled ovary, even though the sepals or petals may be reduced to 2 or 0.

Scheme of Sections.

[Note the female flower may have no petals in groups II, V, VI and VIII.]

A. Anthers black.

* Submerged plants with and linear leaves.

I. SETACEÆ.—Stems to over a foot in length. Leaves 3-6 in.
Head $\frac{1}{8}$ — $\frac{1}{5}$ in.

* * Terrestrial or swamp plants, or if submerged the stem not more than an inch long. Male sepals usually but not always united into a calyx split on the side.

† Female sepals free, boat-shaped or flat, except in VII.

‡ Floral bracts usually black with white hairs on the back.
Receptacle villous except in II a.

- II. SIMPLICES.—Involucre glabrous. All floral parts in 3's. and equal or one female sepal smaller or absent.
- (a) Receptacle ... glabrous.
- (b) Receptacle ... hairy.
- III. HIRSUTÆ.—As II b, but involucre bracts hairy, or also the scapes and leaves.
- IV. ANISOPETALÆ.—As II b, but one male petal much enlarged and projecting so as to hide the floral bracts.
- † † Floral bracts scabrid or puberous, pale: receptacle villous.
- V. SCARIOSÆ.—Female sepals 3 or 2 narrow. Male flowers normal.
- VI. CRISTATOSEPALÆ.—Female sepals strongly boat-shaped and crested on the keel or at least enlarged. Floral bracts puberous in some. Male flowers normal.
- † † Female sepals connate.
- VII. CONNATOSEPALÆ.—Female petals clawed. Male flowers normal. One species only on Himalayas, remainder in China, etc.
- B. Anthers white.
- VIII. LEUCANTHERÆ.—Involucre black or pale. Floral bracts usually dark with white hairs, but also light and glabrous.

General Key to the Groups.

- a. { Plants entirely submerged, leaves linear or ribbon-like b.
- a. { Plants of wet ground, leaves more or less lanceolate d.
- b. { Stem leafy for several inches; heads 1/6 in. or less SETACEÆ.
- b. { Stem O, or if longer and branched, under 3 in. ... c.
- c. { Anthers black, Ls. 1—2 in. (Khasia) E. gregatum or E. barba-caprae.
- c. { Anthers white or yellow stem O; ls. 2 in. or more LEUCANTHERÆ.
- d. { Anthers white or yellow Do.
- d. { Anthers black or greenish e.

- e. { Floral bracts at least the lower, hidden by the
projecting male petals ANISOPETALÆ.
Petals enclosed, or not projecting conspicuously beyond the bracts f.
- f. { Heads white or grey by the hairs on the
otherwise dark floral bracts g.
Floral bracts greenish or brownish, puberous, very closely imbricated. *E. Sexangulare*, *E. cuspidatum*, or *E. Thomasi*.
Floral bracts black, glabrous; female sepals
connate (Himalayas) E. ALPESTRE.
Floral bracts glabrous, yellowish or scarious. h.
- g. { Whole plant hairy, or heads over 1/2 in. diam.
depressed HIRSUTÆ.
Plant glabrous or nearly so, heads globose or
ovoid SIMPLICES.
- h. { Female sepals boatshaped, two at least with
a wing or crest CRISTATO-SEPALÆ.
Female sepals boatshaped or flat SCARIOSÆ.

(To be Continued.)

Explanation of the Figures—(See p. 139.)

- Fig. 1. Male flower of *E. quinquangulare* L.
Fig. 2. Female flower of *E.* do.
Fig. 3. Do. do. *E. trilobum* Ham.
Fig. 4. Male do. *E. caulescens* Steud.
Fig. 5. Female do. *E. Eleanoræ* sp. nov.
Fig. 6. Do. do. *E. minutum* Hook
Fig. 7. Do. do. *E. Thomasi* sp. nov.
Fig. 8. Do. do. *E. alpestre* Hook. f.
Fig. 9. Male do. *E. horsley-kundæ* sp. nov.
Fig. 10. Do. do. *E. Sieboldianum* Sieb et Zucc.
Fig. 11. Female do. *E.* do. do.
Fig. 12. Head of ... *E. Dianæ* sp. nov.
Fig. 13. Do. ... *E. roseum* sp. nov.

THE INDIAN SPECIES OF ERIOCAULON

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(Continued from p. 150.)

I. SETACEAE.

Submerged plants. Stem slender elongate and often branched, bearing leaves for several inches. Leaves very slender, or capillary, 1-5 in. long. Head numerous, 1/10 to 1/16 in., on slender peduncles usually in a terminal umbel, but often also from more than one node. Receptacle glabrous or hairy and chaffy with adherent bracts. Sepals of the male more or less free. All parts of both sexes in threes; stamens 6; anthers black.

Though placed first for convenience because differing from the rest of the genus in their very pronounced aquatic habit and elongated stem, the species which comprise this group should almost certainly be regarded not as primitive, but as aquatic offshoots from the original stock, to which the next group, SIMPLICES, are nearest.

A difficult group to work out in old collections, the heads and the flowers being small, and some confusion has crept in with regard to the species. Linnæus in Sp. Pl. Ed. 1. 1753 p. 87 founded *E. setaceum* on an Indian plant giving as synonym *Randolia malabarica* and quoting also Rheed. Mal. [Hortus Malabaricus] 63. He mentioned only the 6-angled stem and capillary leaves. In Fl. Zeylanica (1747) p. 50 he had mentioned in addition the membranous sheath and submerged roots.* Steudel in Syn. Pl. Cyp. (1855) took this species to be the one with glabrous floral bracts, that being the common Malabar plant. Koerniche in Linnaea XXVII p. 603 took the hairy species as Linnæus' *E. setaceum* and founded *E. intermedium* for the glabrous form on a sheet of Wight's, No. 2369. He considered that Linnæus had been in error in quoting Rheede's figure for *E. setaceum*. Hooker in F.B.I. appears to have reverted to Steudel's conception of the glabrous plant for *E. setaceum* for he described the floral bracts as black and glabrous and founded the new species *E. capillus-naiadis* for the hairy heads. He also identified forms with glabrous heads and glabrous, not villous, receptacles as *E. bifistuloseum* Van Huerck a West African species. Ruhland l.c. reinstated the hairy heads as of *E. setaceum* Linn., reducing Hooker's *E. capillus-naiadis* to that species, and restored *E. intermedium* Koern., at the same time confining *E. bifistuloseum* Van Huerck to West Africa. I find young heads often glabrous, though hairy when fully developed, and that it is impossible to determine with certainty whether the receptacle is glabrous or not, for it is often covered with short scales. I find also that the female petals vary in regard to the position of the gland, which may be well inside the margin as with other species or on it.

It seems however probable that there are in India only two species. *E. setaceum* L. with hairy and *E. intermedium* Koern. with glabrous bracts, and that other differences are casual variations. I have not seen Linnæus type

* I am indebted to Col. Gage, I.M.S., Director of the Botanical Survey, for the copy of Linnæus' descriptions, etc. from which this is taken.

plant but assume that Ruhland did, and follow him and Koerniche in identifying the hairy heads as all *E. setaceum* Linn.

Floral bracts hairy, heads gray or white ... *E. setaceum*.

Floral bracts glabrous, heads black ... *E. intermedium*.

1. **Eriocaulon setaceum** L.; Ruhl. No. 134.; *E. capillunaidis* in F. B. I. vi 572, No. 23. Stem slender, up to 15 inches long (? or more), covered in at least the upper part with long linear leaves. Scapes umbelled at the summit of the stem. Heads $1/6$ in. diam., conical, gray or white. Floral bracts acute, with short white hairs on the backs. Male flowers: sepals 3 free or nearly so; corolla lobes small; anthers black. Female flower: sepals 3 boat-shaped, concave round the seeds; petals 3, oblanceolate with distinct glands. Plate 1.

Assam; Khasia hills: Burma: Ceylon.

In some the female petals are ciliate and with distinct gland well inside the margin; in others they are glabrous with apical gland and distinct midrib.

2. **E. intermedium** Koern.; Linnaea XXVII p. 601; Ruhl. l.c. No. 135; F. B. I. probably *E. setaceum* and *E. bifistulosum*.

Similar in habit to *E. setaceum* Linn, but the floral bracts glabrous, making the heads black. Flowers as in *E. setaceum*, but female petals unequal. Plate 2.

[?] Assam; Khasia: Peninsular India; Malabar: Ceylon.

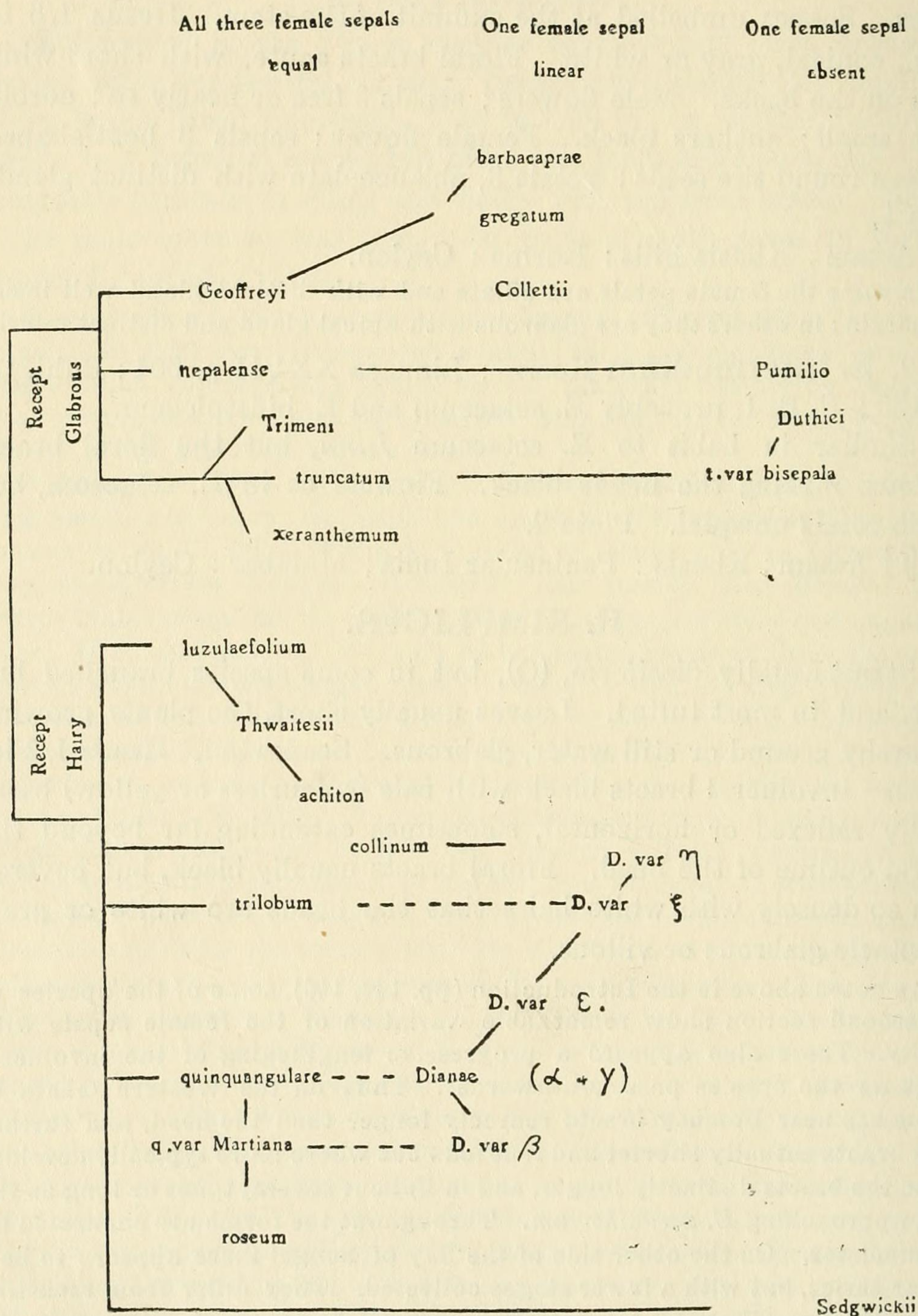
II. SIMPLICES.

Stems usually disciform, (O), but in some species branched but short, and in most tufted. Leaves usually short, the plants growing in marshy ground or still water, glabrous. Scapes tall. Heads $1/2$ in. or less. Involucral bracts black with pale (colourless or yellow) base; usually reflexed or horizontal, sometimes extending far beyond the general outline of the head. Floral bracts usually black, but covered often so densely with white hairs that the heads are white or gray. Receptacle glabrous or villous.

As noted above in the Introduction (pp. 142, 146), some of the species of this second section show remarkable variation of the female sepals with locality. There also appears a progressive lengthening of the involucral bracts as the species pass southwards*. Thus on the Western Ghats *E. Dianae* has near Bombay bracts scarcely longer than the head, and further north bracts actually shorter and reflexed; but where more typically developed has the bracts distinctly longer, and in Calicut several times or long as the head, approaching *E. xeranthemum*. Throughout the forms are connected by intermediates. On the other side of the Bay of Bengal there appears to be a similar series, but with a fewer stages collected. They differ from their like as the Western Ghats by the female sepals all being equal, whereas in the latter one sepal is narrow or reduced to a bristle.

* A similar lengthening of the involucral bracts is shown in other sections; see *E. cuspidatum* *E. Edwardii* and *E. lanceolatum*.

TABLE OF PROBABLE RELATIONSHIPS



SPECIES OF ERIOCAULON § SIMPLICES.

In the table opposite giving the scheme of probable relationship the reduction of one female sepal is shown to have occurred four times and the total loss of a sepal three times. The most involved relationships are shown in the group near the bottom of the diagram. It will be seen that *E. Dianae* is through its varieties connected apparently both with *E. quiquangulare* and with *E. trilobum*. The three species form in fact a closed ring, and the first two with their varieties form a second ring. How this can have come about through descent, I do not propose to discuss here; the facts however are that the species or varieties shown connected by dotted lines are almost or quite indistinguishable except by the character of the one linear sepal, and those shown connected by firm lines are clearly related.

E. xeranthemum and *E. truncatum* with the female sepals 2 or 3, and *E. collinum* with them equal or unequal, contain within themselves the reduction of one sepal.

Key to the Simplicies.

(a) Receptacle glabrous.

* Female sepals 3.

† Female petals broadly oblanceolate or spathulate with large black glands.

- Scapes 10-15 in; heads 1/2 in; female petals visible beyond the bracts (Burma) ... 4 *E. Collettii*.
 Scapes 1/2-2 in; solitary or clustered; heads 1/3 in. (S. Indian Hills) ... 3 *E. Geoffreyi*.
 Scapes 4-5 in., heads 1/4 in. stems branched densely tufted; leaves 2-3 in., linear, (Shillong) ... 5 *E. barba-caprae*.
 Scapes 2-3 in., tufted; leaves 1-1/2 in., linear; heads 1/6 in. (Khasia) ... 6 *E. gregatum*.
 † † Female petals narrow, with small or no glands; or absent.
 Scapes 4-6 in.; heads 1/6-1/4 in., globose ... 7 *E. nepalense*.
 Scapes 1-2 in.; heads 1/8 in., do. ... 8 *E. Pumilio*.
 Scapes 1-1/2-2 in.; leaves 1/3-1-1/4 in., heads 1/6 in. truncate at base (Ceylon) ... 9 *E. Trimeni*.
 Involucral bracts twice as long as the head. 12 *E. xeranthemum*.

* * Female sepals 2, rarely 3.

- Scapes 2-4 in.; heads 1/4 in.; truncate by the very horizontal involucre (Assam to Malacca and to Ceylon) ... 10 *E. truncatum*.
 Scapes 4-6 in.; heads 1/6 in.; bracts reflexed (Central Provinces) ... 11 *E. Duthiei*.

(b) Receptacle villous.

* Female sepals 3 all equally boat-shaped or flat,

† Ls. red or drying red.

- Heads $1/4$ - $1/3$ in. diam., globose or ovoid
 (plains from Bengal to Ceylon) ... 15 *E. quinquangulare*.
- Heads $1/8$ - $1/4$ in. diam.; bracts much longer.
 (Burma) ... 17 *E. roseum*.
- † † Ls. not drying red.
 † Involucral bracts, obtuse, horizontal.
- Scapes 4-15 in. Female. petals oblanceolate
 (Khasia and N. Burma). ... 13 *E. luzulaefolium*.
- Female petals linear, with long basal hairs,
 so brush-like ... 14 *E. Thwaitesii*.
- No female petals, heads obconic ... 15 *E. achiton*.
- † † Involucral bracts reflexed, shorter
 than head; Heads $1/6$ in. (Bengal) ... 19 *E. trilobum*.
- Heads $1/4$ - $1/3$ in.
 Involucral bracts reflexed, shorter than head;
 heads $1/4$ - $1/3$ in. (S. Indian Hills) ... 20 *E. Collinum*.
- * * Female sepals 3, one flat or linear;
 heads grey (Ceylon) ... 20 *E. Collinum*.
- Heads gray or white; involucral bracts
 short or long, horizontal or reflexed.
 (Western Ghats). ... 21 *E. Dianae*.
- * * * Female sepals 2.
- Scapes 4-8 in. Involucral bracts not longer
 than floral; heads densely white villous.
 (N. Kanara) ... 22 *E. Sedgwickii*.

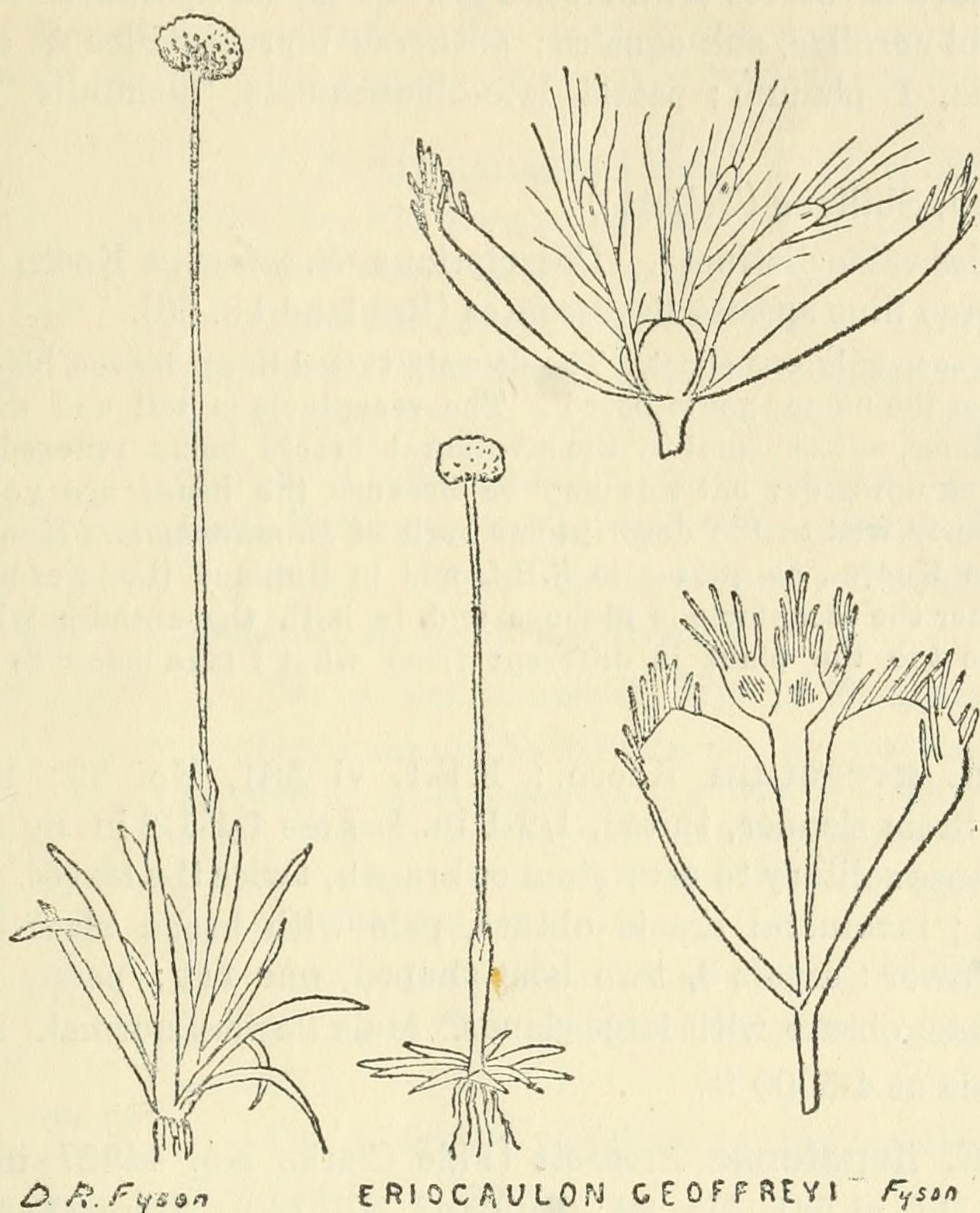
Sub-section (a).

3. ***E. Geoffreyi*** Eyson, Kew Bulletin Nov. 1914, p. 330; Flr. Nil. and Pul. Hill tops p. 432. Stem O. Leaves $1/2$ -2 in., flat tapering to the acute apex. Scapes solitary, in the type, or several, three or four times as long as the leaves. Heads gray; involucre black. Receptacle glabrous. Flowers regular, 3-merous. Petals unusually broad, the female spatulate with large glands. Fig. opp.

Peninsular India; on the Pulneys at 7000 ft.

The type plant was collected at 7500 feet on the Pulneys and is remarkable for the solitary scape rising from a rosette of stiff short leaves. It occurs all over the downs, not in particularly damp spots, and flowers in the autumn. What appears to be a dimerous variety of this species is on a sheet in Herb. Calc., dated July 5th, 1865 collected at "North Hastings."

4. ***E. Collettii*** Hook. f. (Chandler, Shan Hills, in Herb. Calc. marked "identified at Kew"); F.B.I. vi 575, No. 15; Ruhl. p. 114 "incognita."



D. R. Fyson

ERIOCAULON GEOFFREYI Fyson

Stem O. Leaves 3-5 in. by $\frac{1}{3}$ - $\frac{1}{2}$ in. at the base, many nerved, glabrous. Scapes several, 10-15 in., slender, glabrous. Heads $\frac{1}{2}$ in. nearly globose, white; involucral bracts black, reflexed. Receptacle glabrous. Floral bracts acute. Female flr:—Sepals 2 boat shaped, 1 flat; petals longer, broadly oblanceolate or spathulate, with large glands, and protruding beyond the floral bracts. Male flower normal, petals with large glands. Plate 3.

Upper Burma and Shan Hills.

Hooker in F.B.I. placed the species among those with the male petal longer than the others and protruding beyond the bracts, possibly (if the plants taken above as this species are correctly so named) deceived by the very similar appearance of the female petals on the outside of the head. But the male petals are quite equal, and in other respects this appears to belong to this section.

✓ 5. *E. barba-caprae* Fyson, sp. nov. (Collett at Shillong 10/10/90 in Herb. Calc.) Caulis paulum elongatus et divisus hence plantae dense caespitosae. Folia 5-8 cm. longa, basi valde dilatata, linearia, acuta. Pedunculi plures, circe 10 cm. Capitulla 6 mm. Receptaculum

altum, glabrum. Flores tri-meres. Flos. ♂—sepala spathaceo-connata, nigra; lobi corollae, sub-aequales; antherae nigrae. Flos ♀ sepala 2 navicularia, 1 planum; petala late-oblongeolata, glandulis magnis. Plate 4.

Assam, Shillong (Collett!)

Species valde distincta. Descriptione, *E. miserum* Koern. similis, sed antherae eius species flavescens (Ruhland l.c. 68).

I have seen only one sheet. The densely tufted linear leaves, black when dry, suggest the name 'goats-beard'. The receptacle is tall and the heads nearly globose, not as usual by the involucre bracts being reflexed, but by their sloping upwards; but this may be because the heads are young. It answers fairly well to the descriptions both of *E. mitophyllum* Hook. f. and *E. miserum* Koern., as quoted in F.B.I. and in Ruhland (l.c.); except that in the former the receptacle is globose and in both the anthers white. In appearance too the plant is different from what I take below to be these species.

6. ***E. gregatum*** Koern.; F.B.I. vi 581, No. 33; Ruhland No. 69. Stem slender, tufted, 1/2-1 in. Leaves 1-1-1/2 in. by 1/20 in., acute. Scapes solitary to each stem or branch, twice the leaves. Heads 1/8-1/6 in.; involucre bracts obtuse, pale with broad black margin. Female flower: sepals 3, two boat-shaped, one flat; petals broadly oblongeolate, obtuse with large glands. Male flowers normal. Plate 5.

Khasia at 4-5000 ft.

7. ***E. nepalense*** Prescott (Fide Clarke No. 44827 in Herb. Calc.); F.B.I. vi 581, No. 32; Ruhland No. 130. Stem short or O. Leaves flaccid, flat, tapering from 1/8-1/4 in. base, 2-3 in. long, acute. Scapes many, twice as long. Heads 1/6-1/4 in. nearly globular when mature. Involucre bracts black acute, receptacle glabrous. Sepals 3 all boat-shaped. Female petals narrow hairy, seeds oblong with papillose ribs. Plate 6.

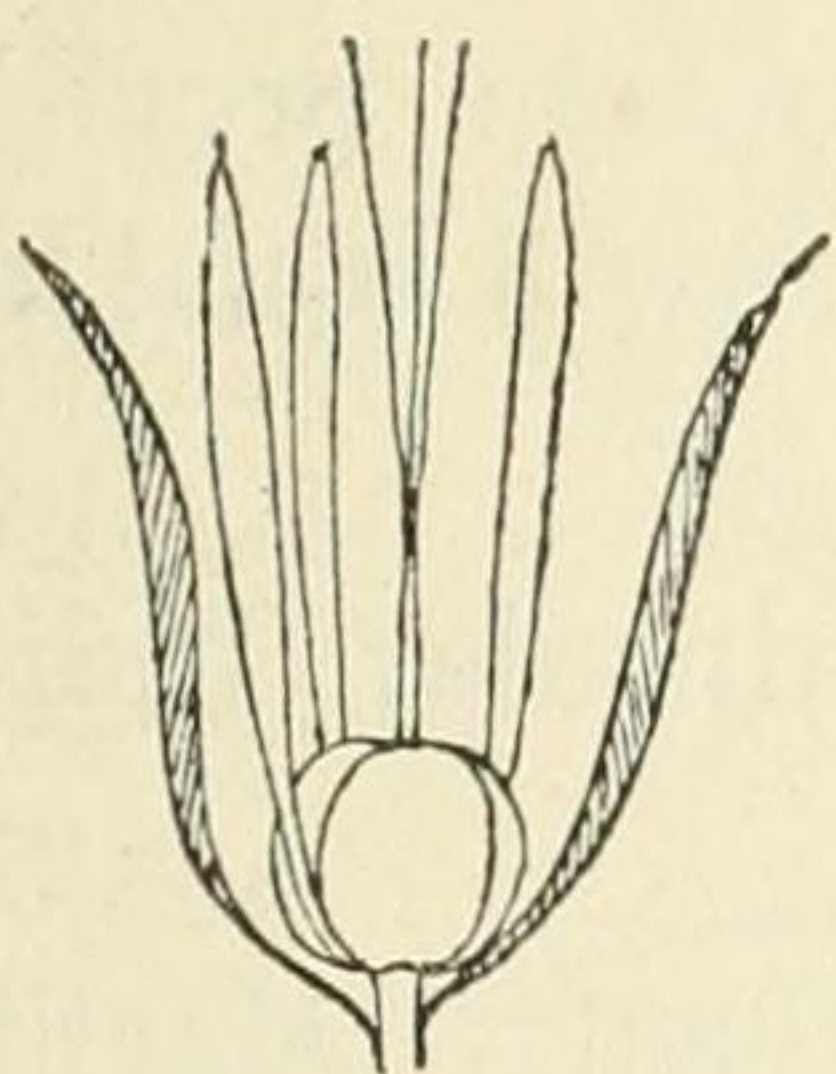
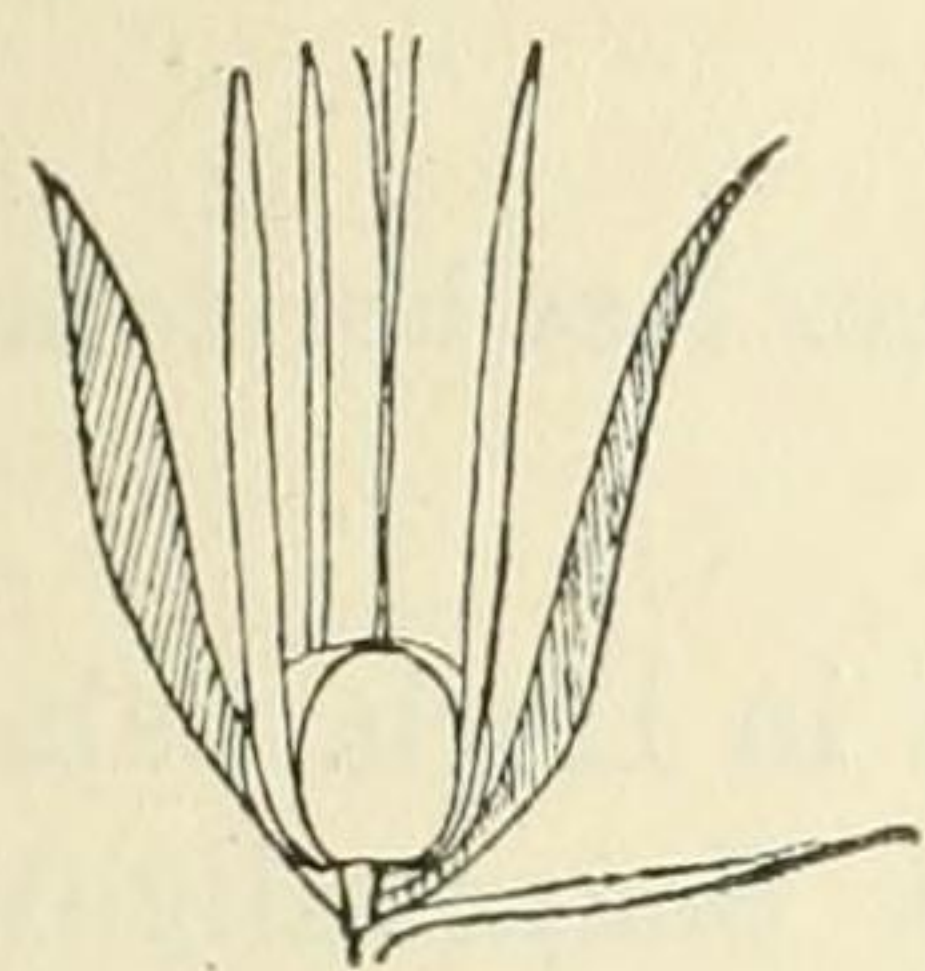
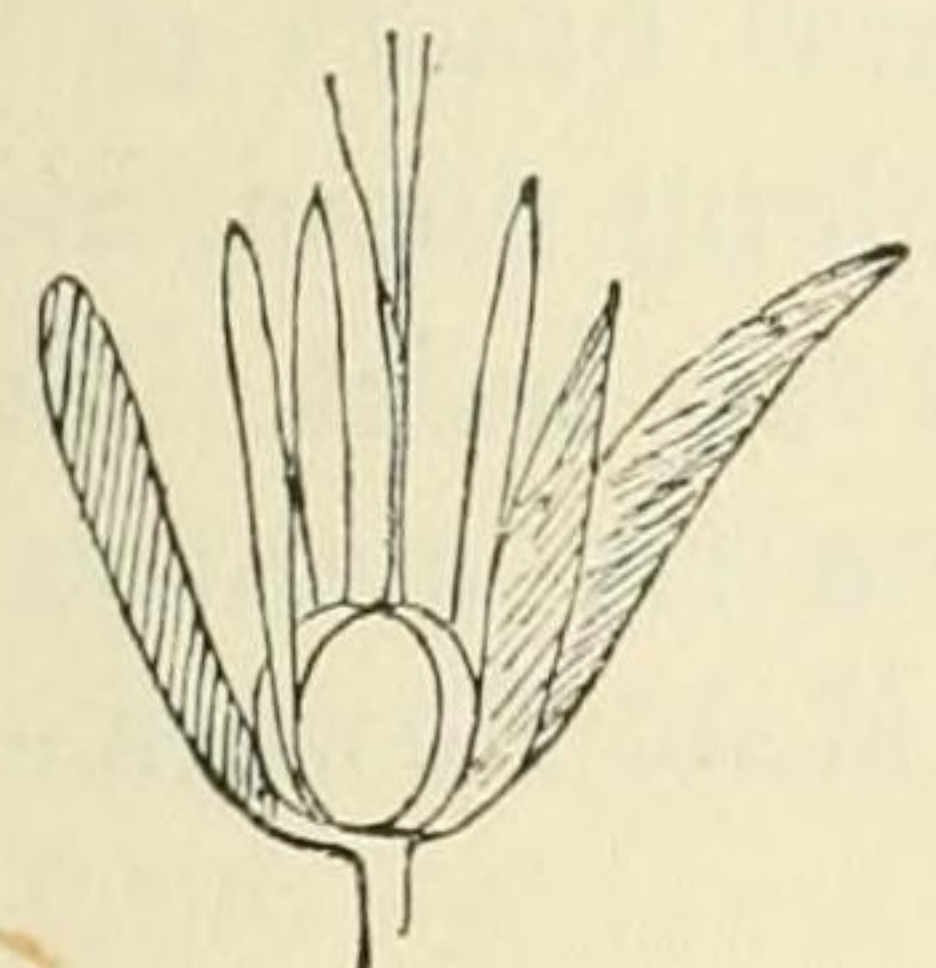
Assam; Khasia: and "from Garwhal to Sikkim." (F.B.I.)

I have not seen the type sheet and am relying on Clarke's plant quoted above, which appears to agree with the description in the F.B.I. The female petals in it have glands, but Ruhland (l.c.) says of the species that there are no glands.

8. ***E. Pumilio*** Hook. f. (Duthie No. 4473 in Herb. Dehra Dun!) F.B.I. vi 581, No. 34; Ruhl. p. 116 'incognita'. Very small. Stem O, tufted. Leaves 1/4-1/2 in. acicular. Scapes 1 in. Heads 1/8. Involucre bracts obtuse, pale nearly or quite horizontal. Floral bracts cuneate-cuspidate, dark but hairy. Receptacle glabrous. Female fl: sepals 2, deeply boat shaped; petals 3. Male fl: normal. Plate 7.

Western Himalayas at 3-4,000 ft.; Kumaon and Garwhal at 8-9,000 ft. (F.B.I.): Nr. Ramri.

I have seen only the one specimen quoted above. The sepals are large, Ruhland says of the species that they are flat and concave only at the tips, but those of the specimen seen by me are quite boat-shaped for the whole length.



VARIATION IN
FEMALE SEPALS.

Taken from a sheet of *E. truncatum* Ham. marked 47. D. Barclay, C. India, 1870.

9. *E. truncatum* Ham.; F.B.I. vi 578, No. 24; Ruhl. No. 178 Leaves usually 1-3 in. flat, narrowed from the base. Scapes several. Heads hemispheric. Involucre horizontal, scarious, not or hardly projecting beyond the head. Receptacle glabrous. Floral bracts very obtuse, nearly glabrous. Female sepals narrow, 2 boat-shaped, toothed at the apex, and third sepal if present acute; or 2 only. Petals 3 narrow.

Bengal, Assam, North Burma and southwards to Malacca; S. India and Ceylon.

Var. *a vera*, Tipperah, Mts. of Monghir.

This I take to be the true species, for Mart. in Wall. As. Rar. iii, p. 29 describes the flower as having a third sepal. But Koerniche in *Linnaea* xxvii, p. 633, Hooker in F.B.I. l.c. and Ruhl. l.c. both give the commoner 2-sepalled flower of the next variety.

Var *b di-sepala*. Female sepals 2, otherwise as in the type. The wider distribution given for the species.

For a similar variation in the female sepals see *E. Thwaitesii* Koern.

Two sheets in Herb. Calc. unfortunately without precise locality but one marked C. India, are similar in many respects, but the floral bracts are cuneate acute, not rounded. The female sepals vary in the same head, 3 equally boatshaped or one linear, or two only. Except for the glabrous receptacles these plants might be *E. Dianae*. (No. 20).

10. *E. Trimeni* Hook. f. (Bambulla Rk. 1881 in Herb. Ceylon!) Fl. Ceylon, 1900, v p. 8; Ruhl. p. 117, "incognita". Scapes 1/2-2 in. leaves 1/3-1/4 in. narrow to linear. Heads 1/10-1/8 in. Involucral bracts hyaline, as long or slightly longer than the floral, sub-erect. Floral bracts cuneately oblong or obovate. Receptacle glabrous. Male flowers, sepals 3, but 2 connate; sta 6 (not 1). Female flowers, normal; seeds glistening yellow, smooth.

Ceylon.

Hooker l.c. compared this with *E. Sieboldianum*, but the black anthers and flatter head sufficiently distinguish it. Hooker also in error described the male flowers as having only one stamen. There are 6 quite clearly in the plant quoted above. It was referred to *E. truncatum* Ham. by Trimen, and though differing in its flower and in the involucre being less horizontal is clearly allied to that species.

11. **E. Duthiei** Hook. f. (Duthie No. 8436 in Herb. Dehra Dun !) F. B. I. vi 579, No. 22 ; Ruhl. No. 174. Stem O. Leaves $\frac{3}{4}$ in. long, broadly oblanceolate acute from a $\frac{1}{6}$ in. wide base. Scapes numerous 1 to 6 in. slender. Heads $\frac{1}{6}$ in. Involucral bracts pale, not projecting beyond the floral. Floral bracts oblong cuspidate, nearly glabrous. Receptacle tall, glabrous or with a few hairs. Sepals 2 only, in both sexes. Female petals narrow, nearly glabrous. Seeds oval, yellowish brown with darker markings. Male flowers.—Sepals 2 ; otherwise normal, anthers black. Plate 7.

Central Provinces, one collection only seen.

The scapes are taller, the heads smaller and the involucre less horizontal than in *E. truncatum*.

12. **E. xeranthemum** Mart. (Wall Cat. 6081 in Herb. Calc !) F.B.I. vi 584, No. 43 ; Ruhl. No. 150 Leaves $\frac{2}{3}$ - $\frac{1}{2}$ in. Scapes slightly longer or shorter. Disc of head $\frac{1}{10}$ - $\frac{1}{8}$ in. Involucral bracts much longer, glistening white. Receptacle globose, floral bracts broadly obovate truncate, hairy at the tip. Female sepals narrow 3 equal or unequal or 2 only. Fig. opp.

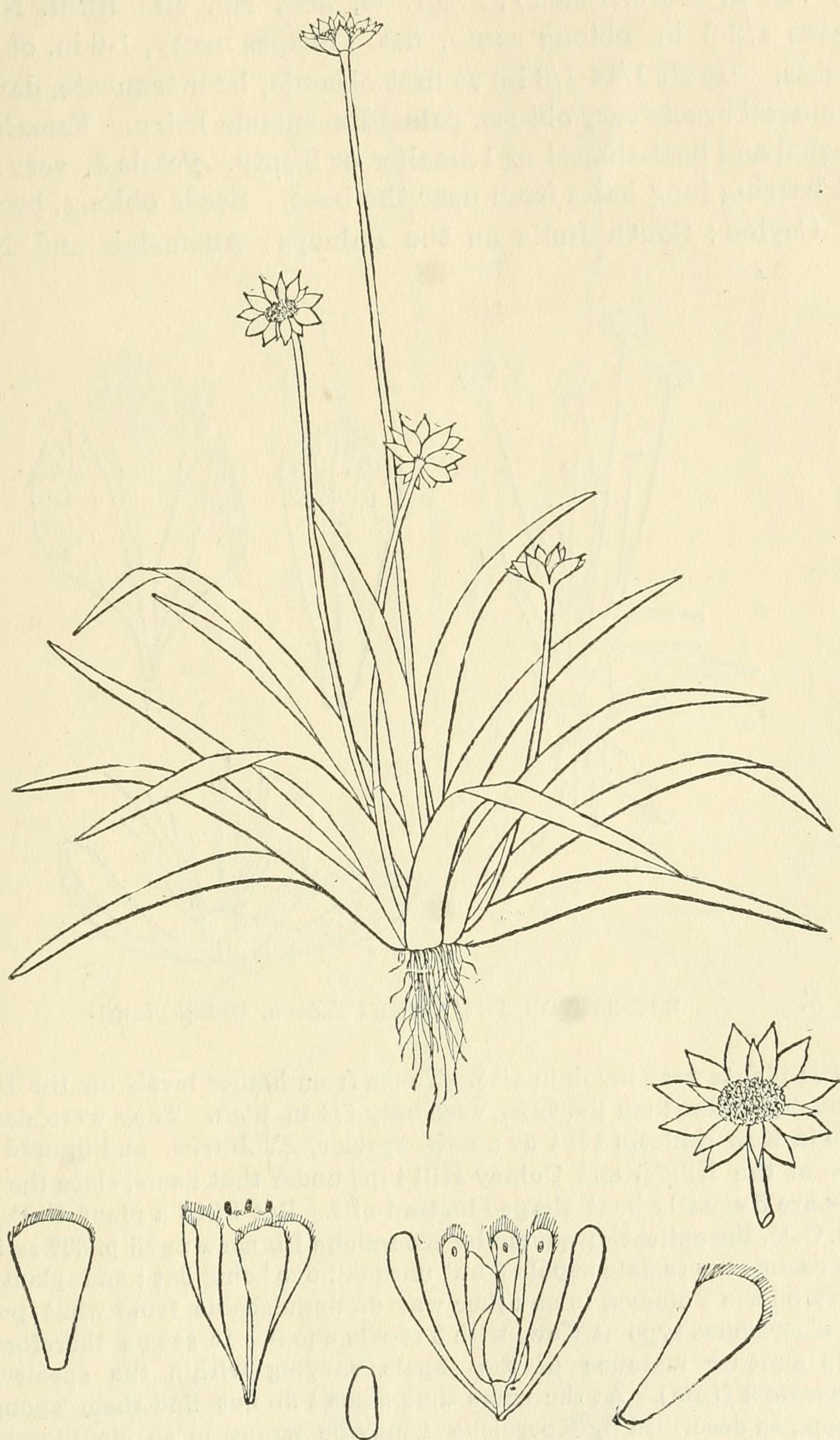
Central Himalayas, Nepal ; Assam, Khasia, Peninsular India, Malabar, Cochin, etc.

Hooker in F.B.I. describes the receptacle as hairy, but wrongly. Martius in Wall. Pi. As. Rar. Vol. iii says the hairiness is the only real reason for distinguishing *E. xeranthemoides* from this species. Hooker also gives the sepals as 2. Koerniche in Linnaea xxvii p. 626 gives them as 3, but unequal. I find both the petals and sepals of the female flowers vary in size among themselves and one sepal may be linear or absent.

13. **E. luzulaefolium** Mart. (Wall. Cat. 6071 in Herb. Calc !) ; F.B.I. vi 582, No. 35 in part ; Ruhl. No. 131 in part. Leaves 2-4 in. narrowed from the $\frac{1}{6}$ in. base, flat, many-nerved. Sheaths about as long. Scapes many, 2 to 4 times as high, slender. Heads $\frac{1}{4}$ in., truncate, clasped below by the light ? brown obtuse saucer shaped involucre. Floral bracts dark with white hairs, making the heads gray. Receptacle hairy. Sepals and petals three, narrow. Plate 8.

Central Himalayas, Nepal, Assam ; Silhet (type sheet !) ; Lr Bengal ; and the Shan States.

Hooker in F.B.I. has a much wider distribution extending over all India, Ruhland merely repeats this. But the sheets seen by me with that name from Madras, Kanara and other parts are not the species of the above quoted type. The Ceylon plant C. P. 796, so named, has none of the characteristic truncate appearance of the head on a saucer-shaped involucre and is *E. collinum*. Wallich's plant quoted above does not in fact resemble *E. quinquangulare* as stated by Hooker.



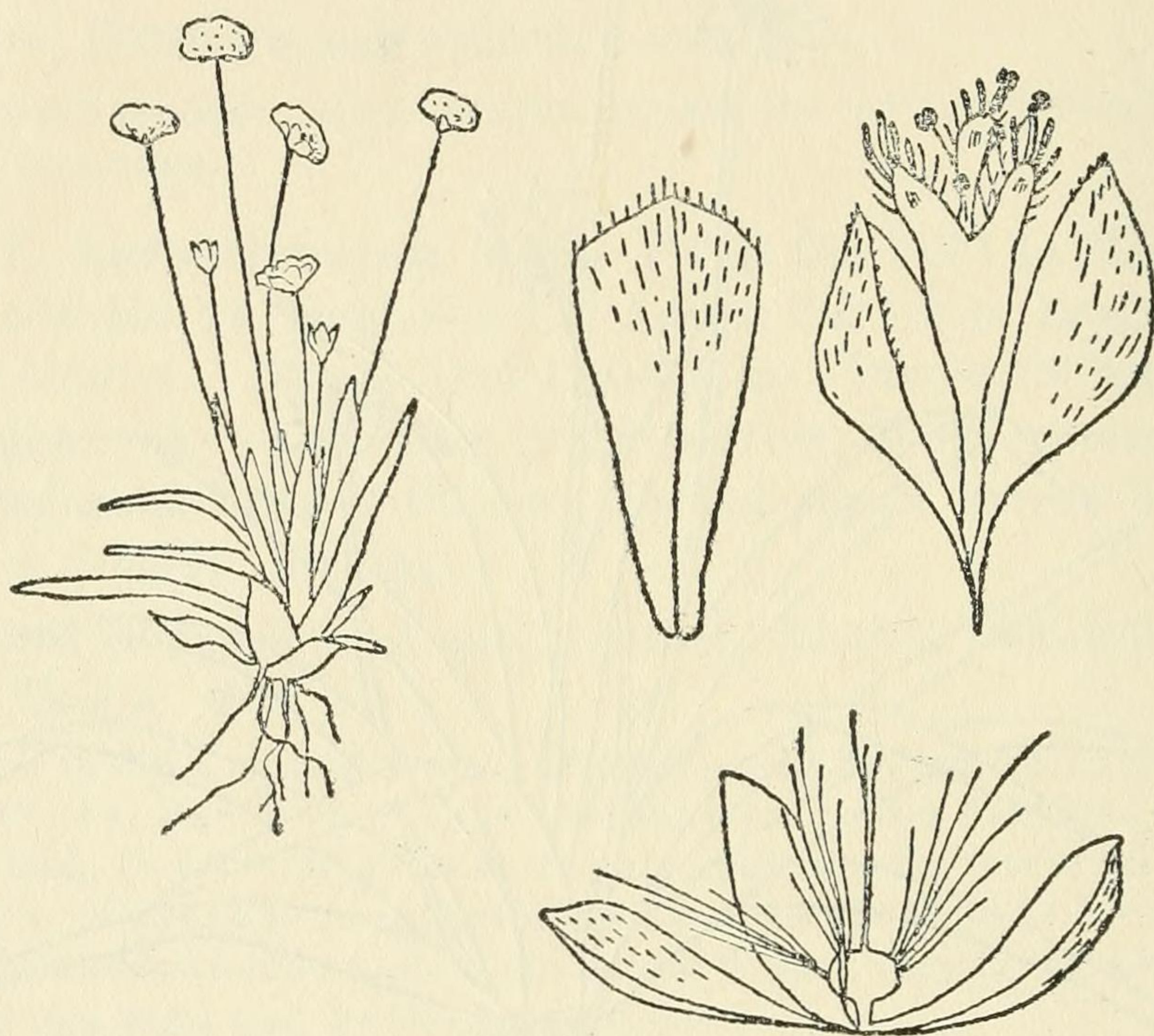
M. V. Rungam.

ERIOCAULON XERANTHEMUM.

Mart.

14. **E. Thwaitesii** Koern. (C. P. 790 and 769 in Herb. Kew. and 790 in Herb. Calc.); F.B.I. vi, 583, No. 40; Ruhl. No. 171. Leaves $1\frac{1}{2}$ -2 in. oblong acute, flat. Scapes many, 1-6 in. of various heights. Heads $1\frac{1}{14}$ - $1\frac{1}{3}$ in. at first obconic, later truncate, dark gray. Involucral bracts very obtuse, pale. Receptacle hairy. Female sepals 3, equal and boat-shaped or 1 smaller or 2 only. Petals 3, very slender and bearing long hairs from near the base. Seeds oblong, brown.

Ceylon; South India on the Pulneys; Anamalais and Nilgiris.

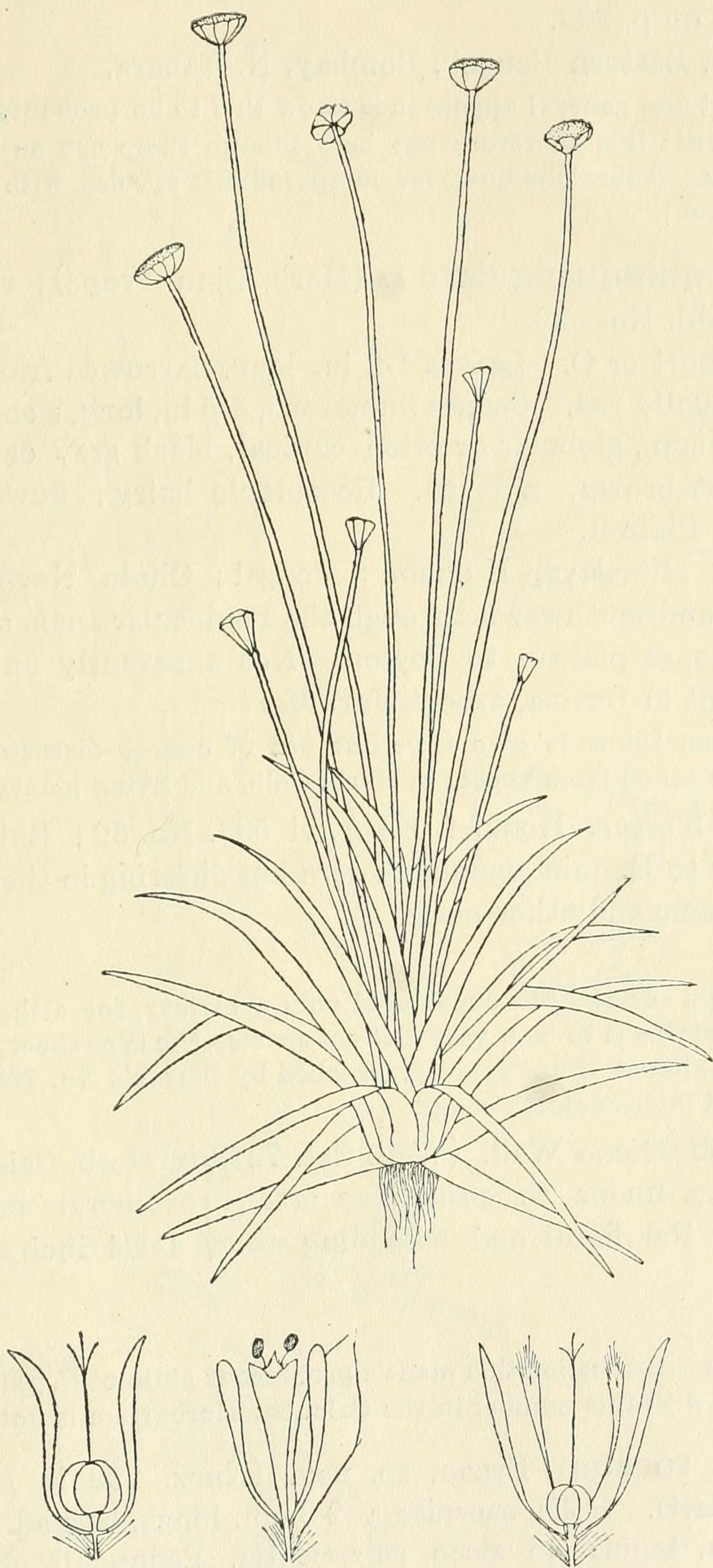


D R. F.

ERIOCAULON THWAITESII Koern. (small plant)

The plants vary much in size. Those from higher levels on the Pulneys are much smaller than the type, even only $\frac{1}{2}$ in. high. They were described by me in Kew Bulletin 1914 as a new species, *E. Mariæ*, and figured in my Flora of the Nilgiri and Pulney Hill tops under that name, since the female sepals are 3 equally boat shaped instead of 2. But I find a plant C. P. 790 in Herb. Calc. the collection quoted by Koerniche Linnaea xxvii p. 627 as in part his type, has the female sepals 3 but unequal, one being flat; and plants from 5,000 ft. on the Pulneys, in no other way distinguishable from what purports to be Koerniche's type at Kew, with 3 sepals equal. It seems therefore that this is another instance of the sepals varying within the species, (c. f. *E. truncatum* Ham). At the same time since I do not find them spongy at the back, as described by Koerniche I may be wrong in so identifying these plants.

15. **E. achiton** Koern. (Clarke in Herb. Calc.); F.B.I. vi 584, No. 42; Ruhl. No. 189. A smaller plant than *E. Thwaitesii*. Leaves narrow, almost linear about 1 inch. Scapes twice as long slender.



ERIOCAULON ACHITON.

Koern.

Heads obconic or hemispheric. Sepals of both sexes 2 only, narrow. Female petals 0. Seeds broadly ovate, dark brown, with longitudinal lines. Fig. on p. 203.

Khasia, Eastern Bengal; Bombay, N. Kanara.

The habit and general appearance show this to be probably a derivative of *E. Thwaitesii*; it is therefore put here though there are no petals in the female flower. Koernicke however compared this species with *E. truncatum* Mart. [? Ham.].

16. *E. quinquangulare* L. (Herb. Linn. Prop!); F.B.I. vi 582, No. 36; Ruhl. No. 122.

Stem short or 0. Leaves 1-2 in. long, narrowed from the 1/4 in. base flat, usually red. Scapes numerous, 3-5 in. long, slender. Heads 1/5-1/4 in diam., globular or often conical, black gray or white. Involucre light brown, reflexed. Receptacle hairy; flowers normal; sepals flat. Plate 9.

Central Himalaya, Kumaon; Bengal; Chota Nagpur; Central Provinces; and southwards through the Peninsular India on the plains and the Mysore plateau to Ceylon. Not apparently on the higher levels and not in Burma, except Var. *Martiana*.

I have seen Linnæus' own type but not of course dissected it, and the description is taken from sheets in Herb. Calc. and living plants.

Var. b. *Walkeri* Hook. f. F.B.I. vi 583, No. 39; Ruhl. No. 123. Very similar to *E. quinquangulare vera* but differing in the much more hairy receptacle and other parts.

Ceylon.

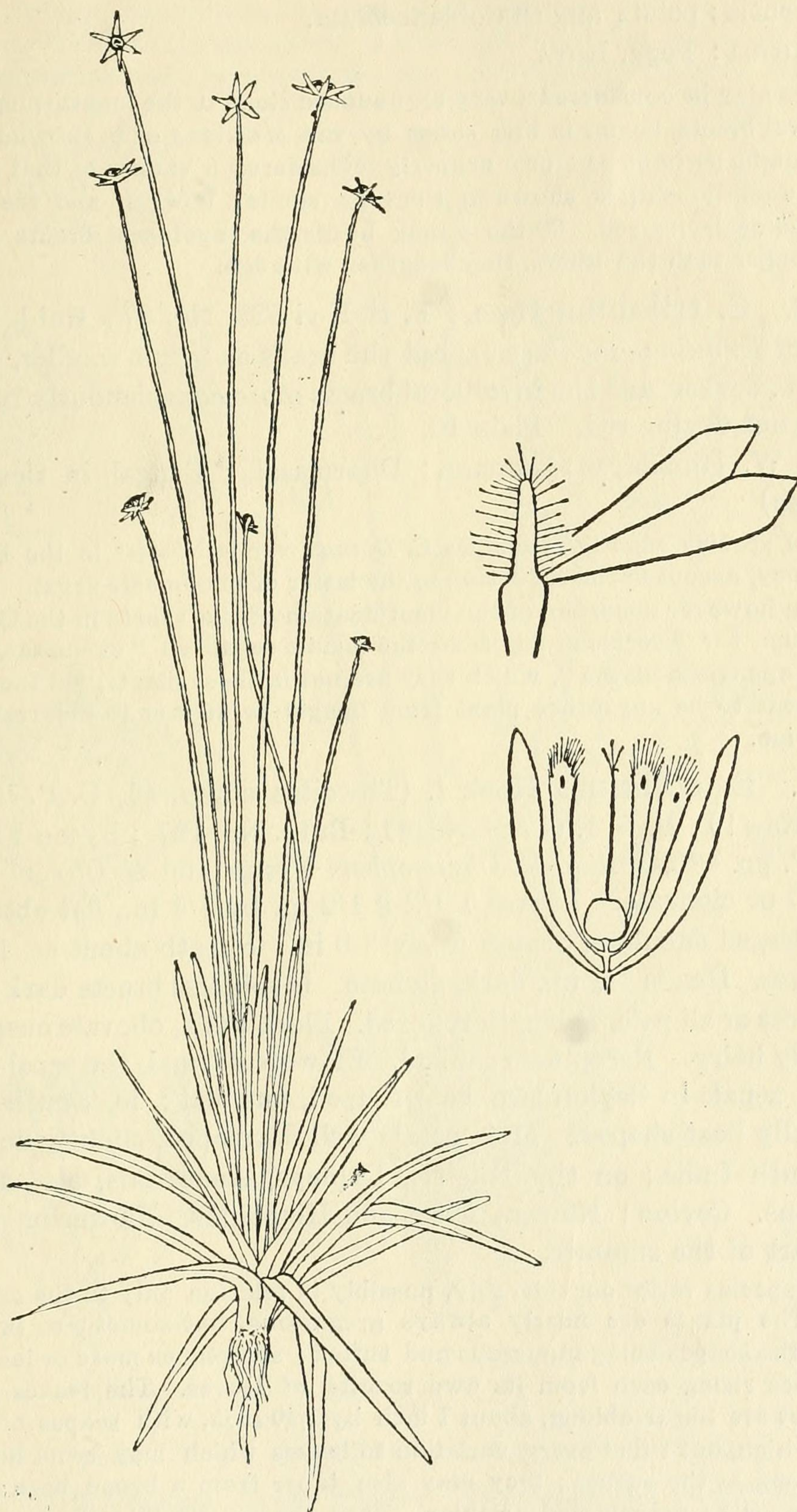
This should certainly be considered only a variety, for although Hooker in the F.B.I. states it to be a very distinct species, the type sheet in the Ceylon Herbarium is almost, if not exactly, matched by Clarke's No. 20849, collected in Bengal, and intermediates occur.

Var c. *Martiana* Wall. (Wall. Cat. 7279 in Herb. Calc. !); F.B.I. and Ruhl. l.c. under *E. quinquangulare*. Involucral bracts much longer than the floral and extending about 1-1/4 inch beyond the head.

Burma.

Hooker in F.B.I. called this plant a proliferous state of *E. quinquangulare*. But the plant with this number in the Calcutta Herbarium is not proliferous.

✓ 17. *E. roseum* Fyson, sp. nov. (Kurz. 232 in Herb. Calc.) Caulis perbrevis. Folia caespitosa 2-8 cm. longa, basi ad apicem contracta, plana, tenuia, in sicco rubescentia. Pedunculi plures, valde tenuia, glabra, 10-25 cm. alta. Capitula 4-6 mm., lata, sed bractae involucrantes demum 2-3 mm. longiores, tenues et reflexae. Bractae flores superantes acutae, nigrescentes. Receptaculum altum, valde villosum. Flores trimeri, flos ♂; sepala in spathan antice fissam connata;



ERIOCAULON ROSEUM.

Fyson.

petala parva, subequalia ; antherae nigrae. Flos ♀ :—sepala aequalia, nigrescentia ; petala angusta-ob lanceolata.

Burma : Pegu, Kurz.

This may be considered a very pronounced stage in the lengthening of the involucral bracts, begun in this series by var. *Martiana* of *E. quinquangulare* and it might perhaps be more properly considered a variety of that species. Its close relationship is shown in the very similar flowers, and the leaves being red or drying red. Of the young heads the involucral bracts are not much longer than the others, they lengthen with age.

18. **E. trilobum** Ham. ; F. B. I. vi 583, No. 37 ; Ruhl. No. 88 Habit of *E. quinquangulare* L., but the heads as a rule smaller, 1/8-1/6 in diam., darker, and the involucral bracts more conspicuously reflexed. Leaves not drying red. Plate 10.

N. W. Himalayas ; Kumaon ; Dharmasala ; Bengal, in rice fields (Wallich)

This species exactly resembles *E. Dianae*, var *triloboides* in the Bombay Presidency, except in the reduction in the latter of one female sepal.

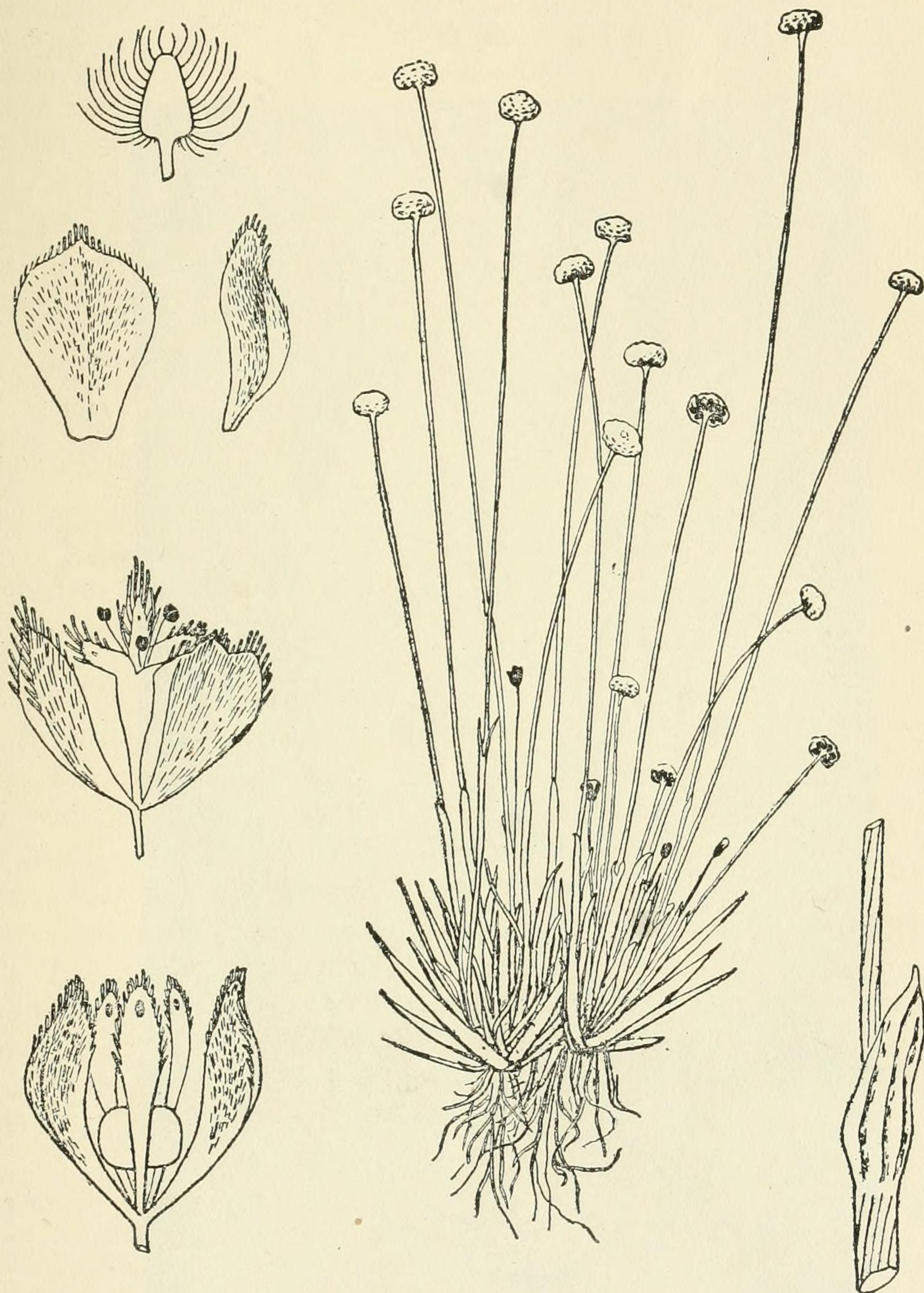
I am however uncertain of the identification of the sheets in the Calcutta Herbarium, for Koernicke describes the female sepals as "carinatae, dorso anguste spongioso alatae", which they are not in these plants, yet there does not appear to be any other plant from Bengal to answer to the rest of the description.

19. **E. collinum** Hook f. (Thwaites enum, 44, C. P. 1000 in Herb. Kew !) ; F. B. I. vi 584 No. 41 ; Ruhl. No. 127. ; Fyson Fl. N. & P. H. T. pp. 430,-1. incl. *E. Christopheri* Fyson and *E. Oliveri* Fyson Stem O or elongate. Leaves 1 1/2-2 1/2 in. by 1/4 in., flat obtuse or if submerged subulate. Scapes many 3-8 in. Sheath about as long as the leaves. Heads 1/4 in., dark, globose. Involucral bracts dark or the outermost or all pale, at length reflexed. Flora dark, obovate cuspidate, sparingly hairy. Receptacle conical. Flowers normal, the sepals dark. Female sepals in Ceylon two boat-shaped, one flat ; in South India all equally boat-shaped. Male petals well developed, slightly unequal.

South India ; on the Nilgiris, Pulneys, Anamalais, etc., at high elevations. Ceylon ; Newara Eliya and Highlands. Flowering in the early part of the summer.

The species varies considerably, possibly in relation only to the environment. The plants are nearly always gregarious, but sometimes in dense clumps, the scapes being numerous and tufted ; sometimes more or less free, the scapes rising each from its own rosette of leaves. The leaves in the type sheet are linear-oblong, about 1 inch by 1/10 inch, with scapes of 7 or 8 times as high, but I find every variation to leaves which may be as much as half as long as the scapes ; they may also taper from a broad base evenly to the tip or be narrow and acicular. They are usually thin or flaccid but may be coriaceous. The heads typically gray with black involucre may be almost white with colourless (pale) involucral bracts. The male petals are not quite equal and in one Pulney plant one male petal of the lowest

flowers of the head is much larger and projects beyond the bracts giving the head a fringed appearance, like that of *E. longicaspis*, but much less pronounced. This feature disappears in dried specimens, but the plant is different in appearing much later on in the year, on bank above the free surface of



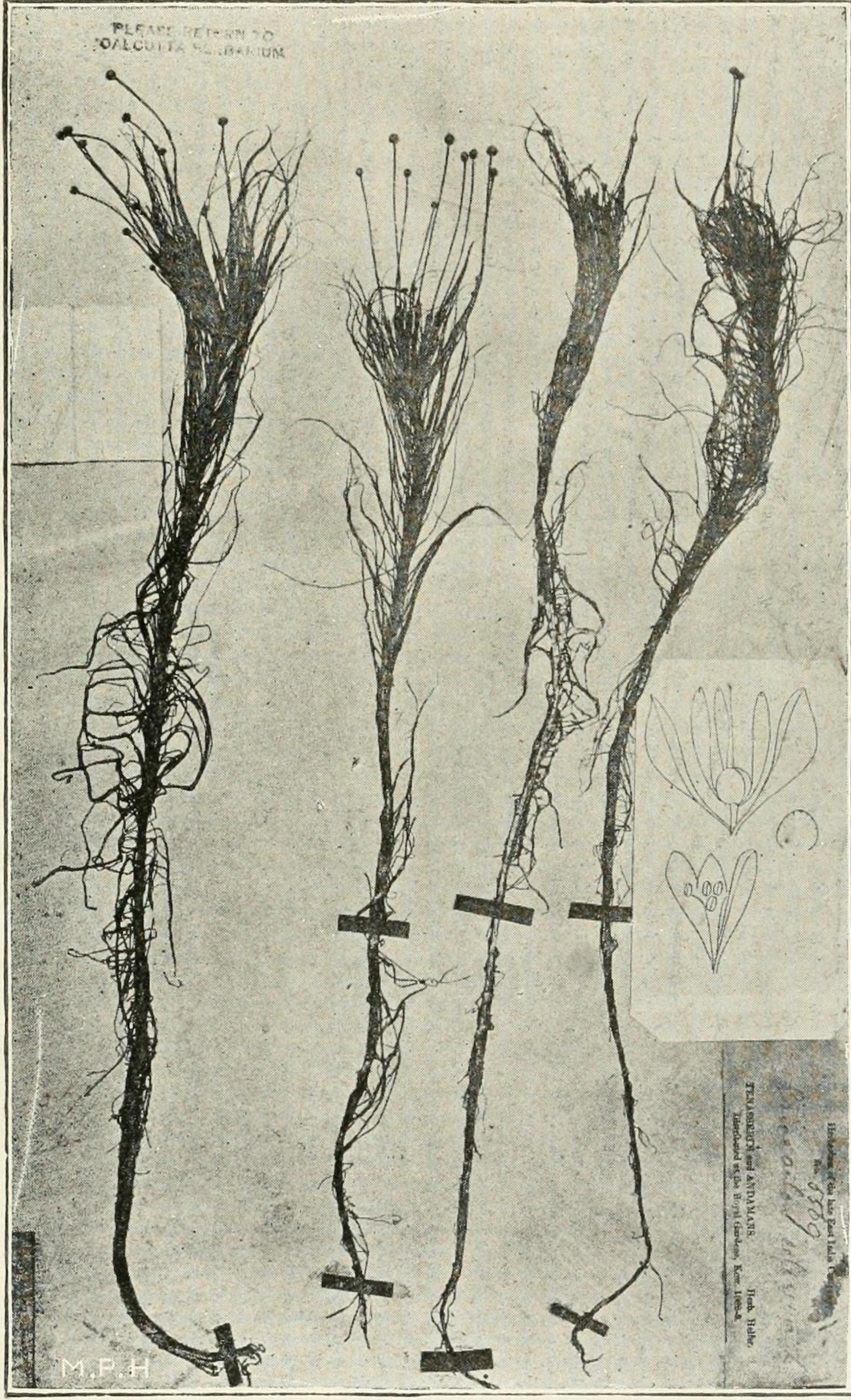
D.R. Fyson

ERIOCAULON COLLINUM Hook.

water, not in swamps. In the Flora of the Nilgiris and Pulney Hill tops I separated two forms as new species, but a comparison of a very large number induces me to reduce these again to *E. collinum* Hook. f. with the assumption that the female sepals may vary as between the Ceylon and the S. Indian forms.

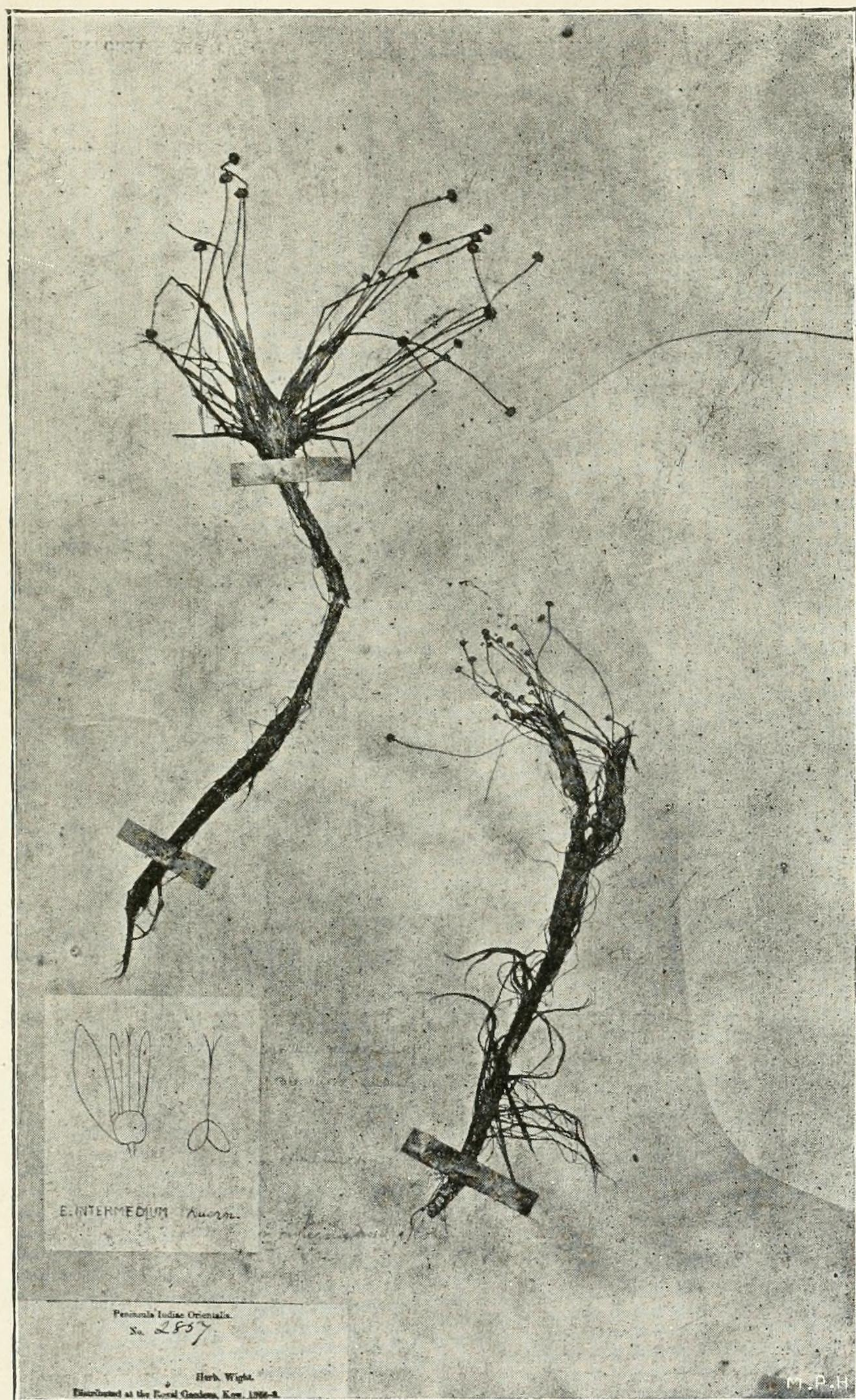
(To be Continued.)

INDIAN SPECIES OF ERIOCAULON, PL. 1.



ERIOCAULON SETACEUM L.

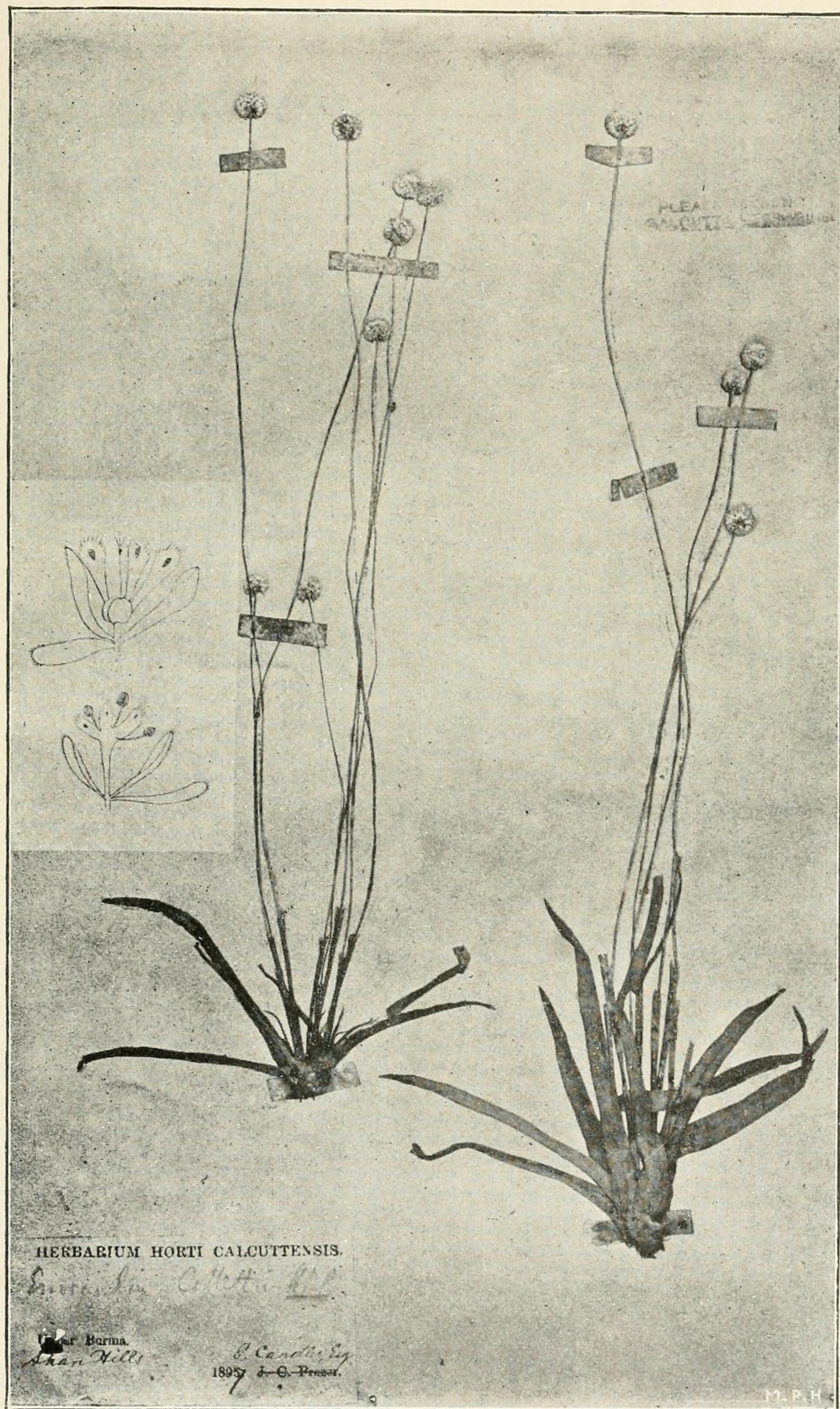
INDIAN SPECIES OF ERIOCAULON, PL. 2.



ERIOCAULON INTERMEDIUM

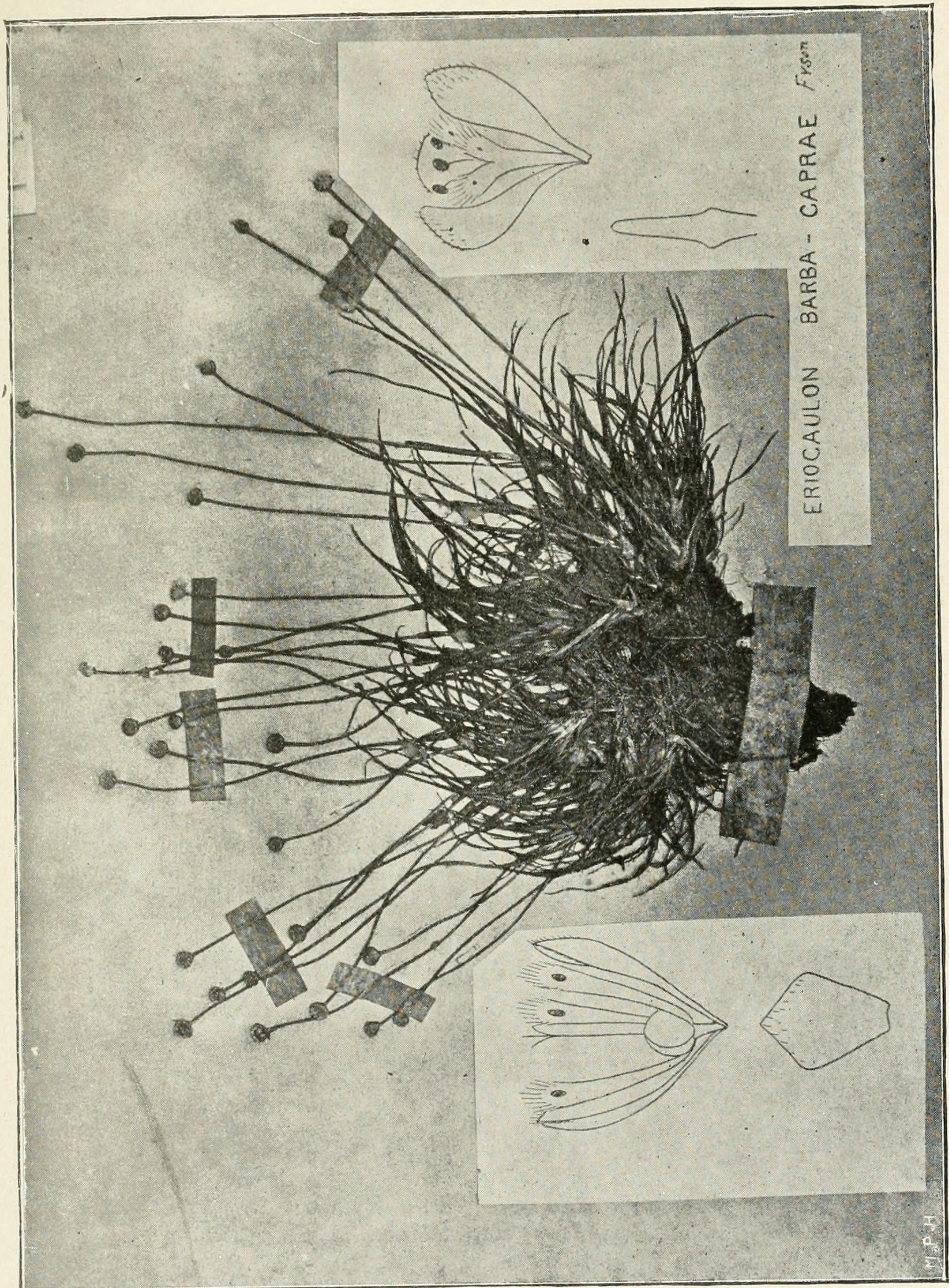
Kærn.

INDIAN SPECIES OF ERIOCAULON, PL. 3.



ERIOCAULON COLLETTII

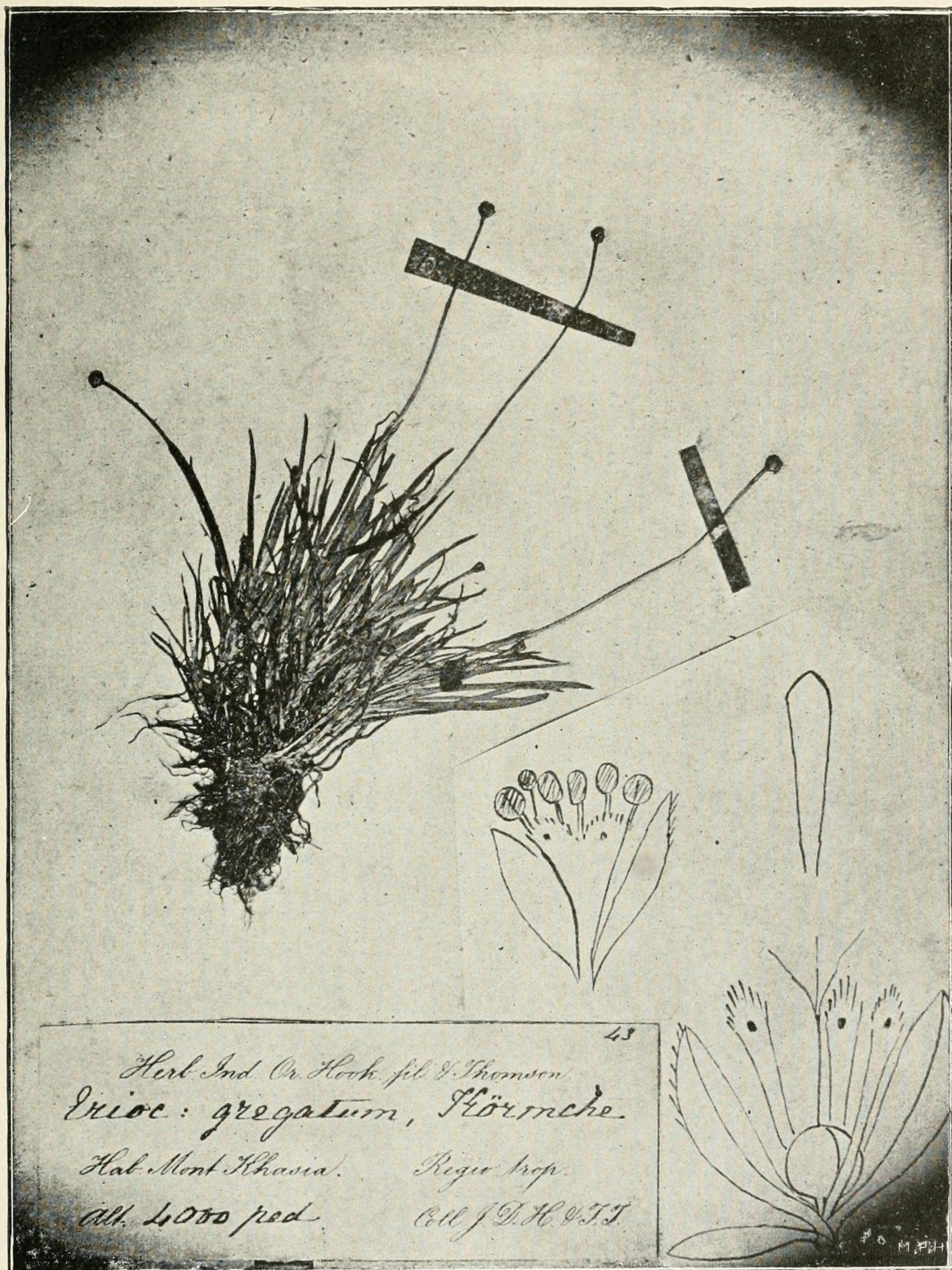
Hook f.



Fyson.

ERIOCAULON BARBA-CAPRAE

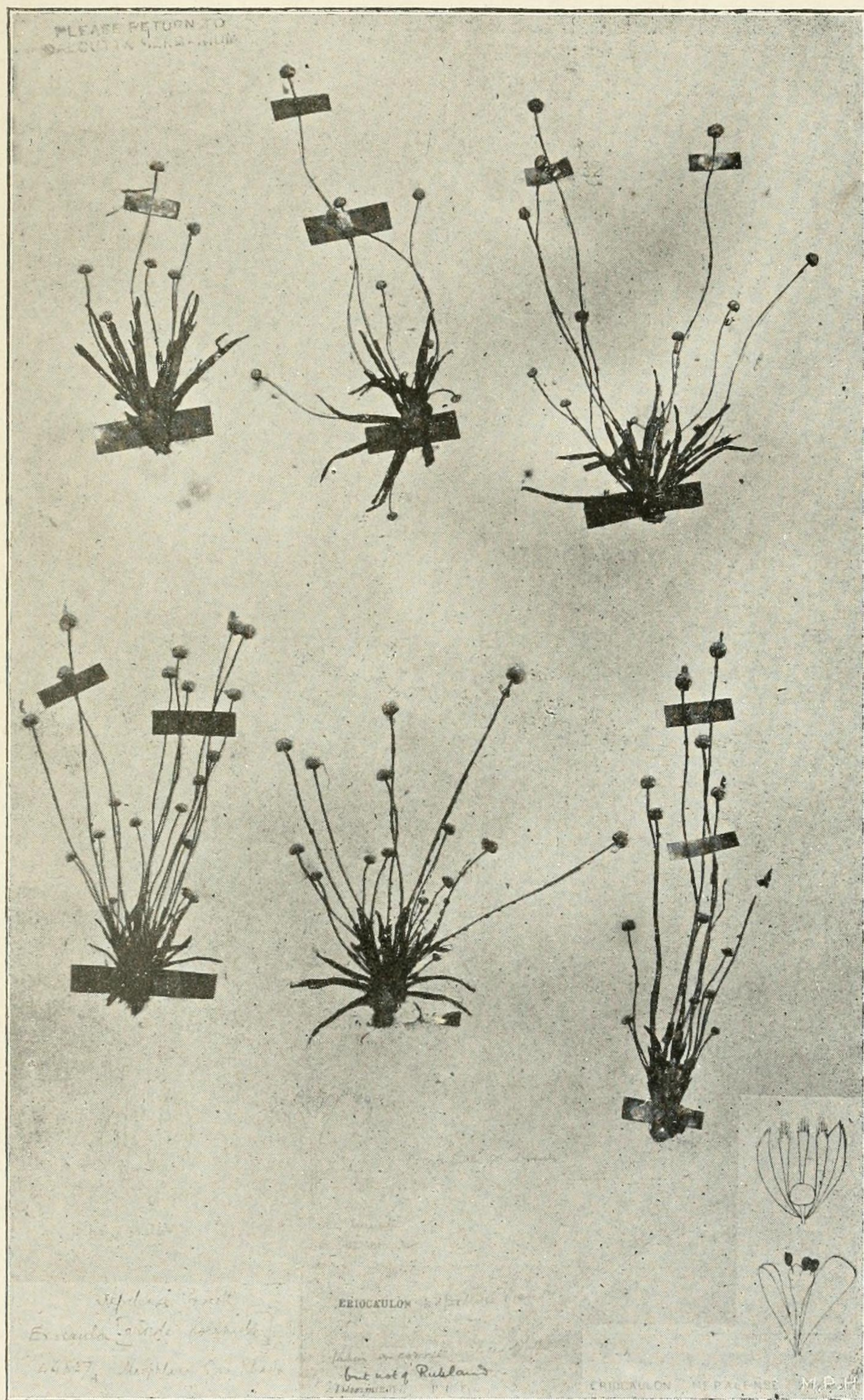
INDIAN SPECIES OF ERIOCAULON, PL. 5.



ERIOCAULON GREGATUM

Körn.

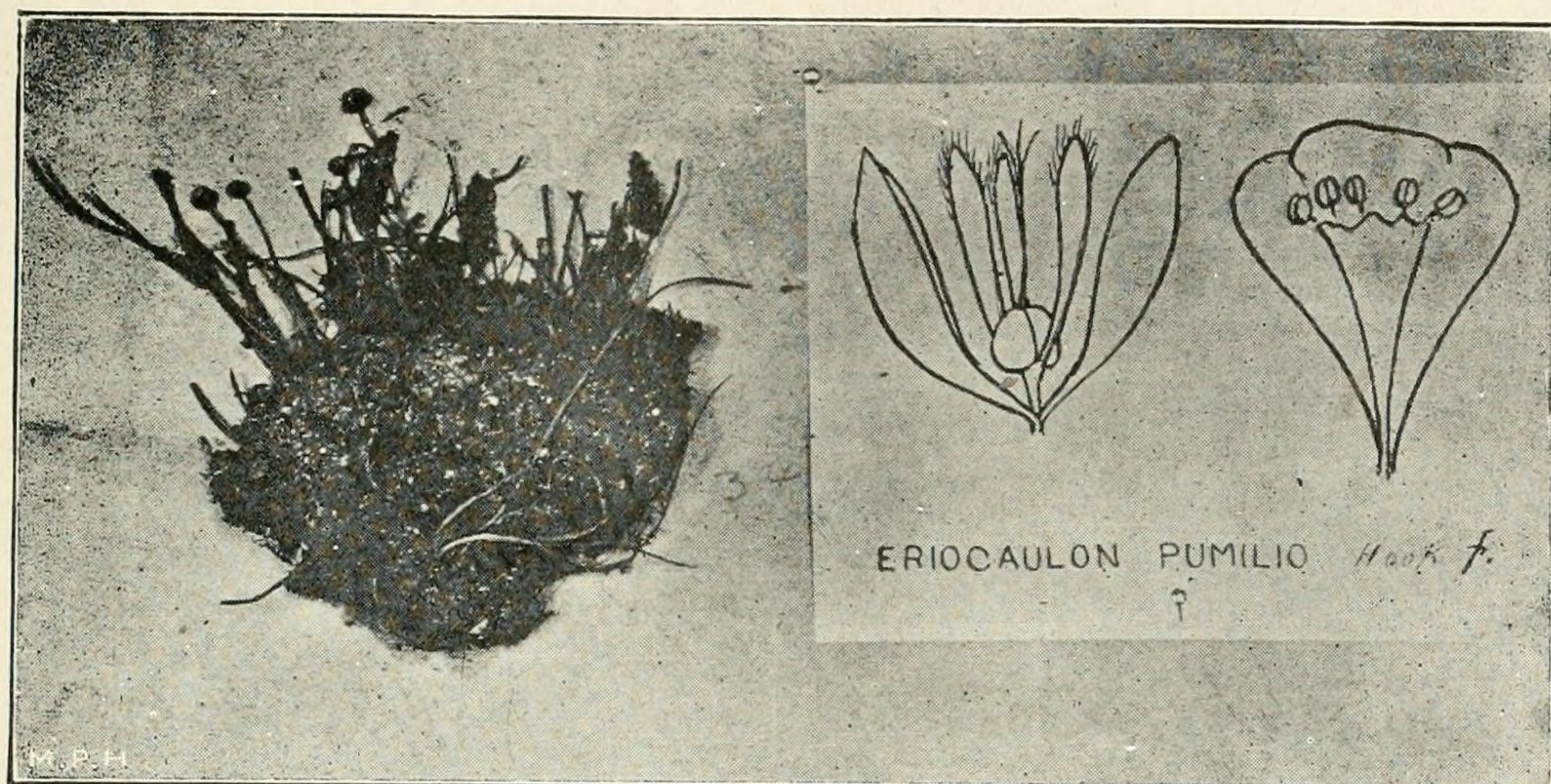
INDIAN SPECIES OF ERIOCAULON, PL. 6.



ERIOCAULON NEPALENSE

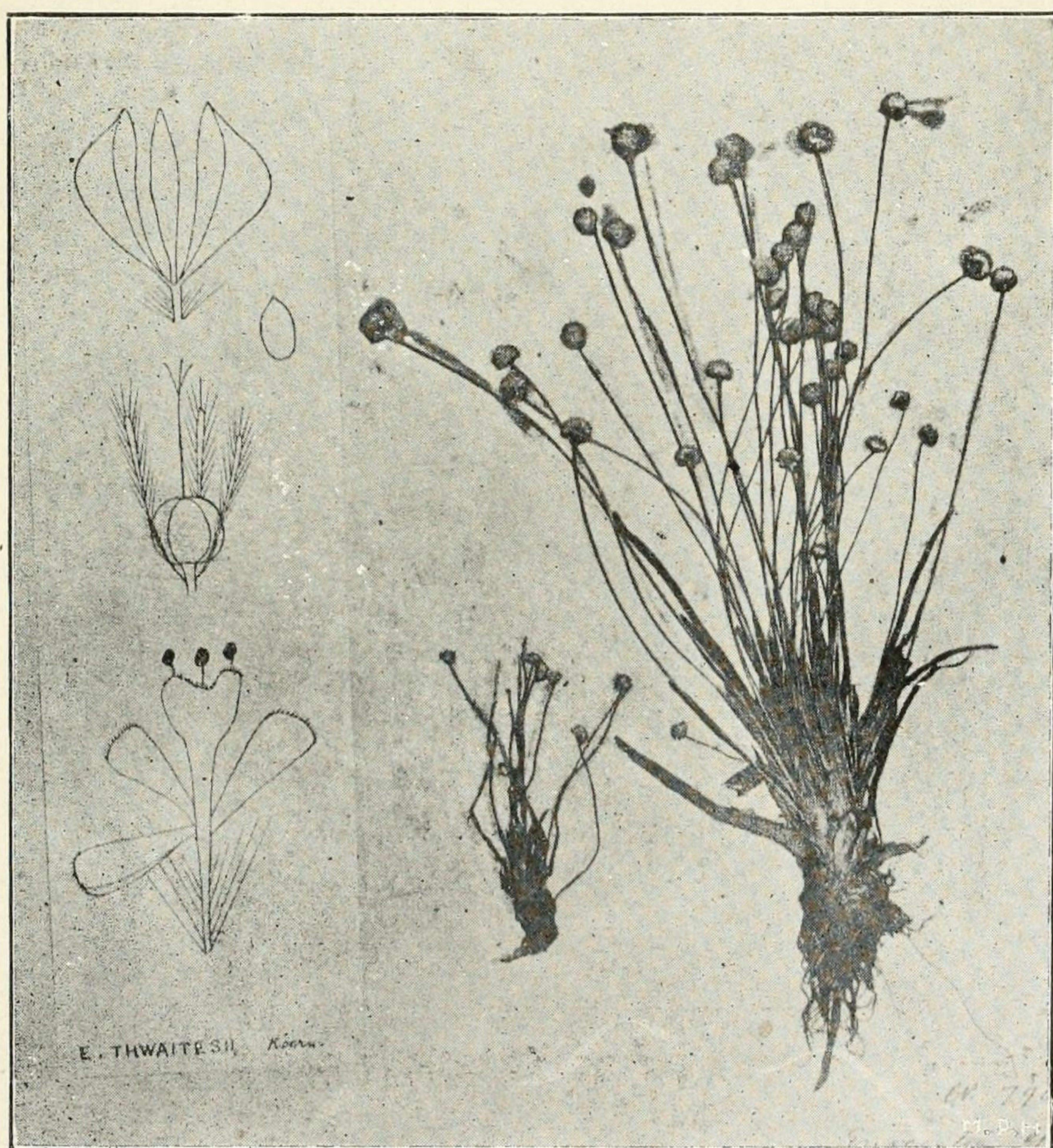
Prescott.

INDIAN SPECIES OF ERIOCAULON, PL. 7.



ERIOCAULON PUMILIO

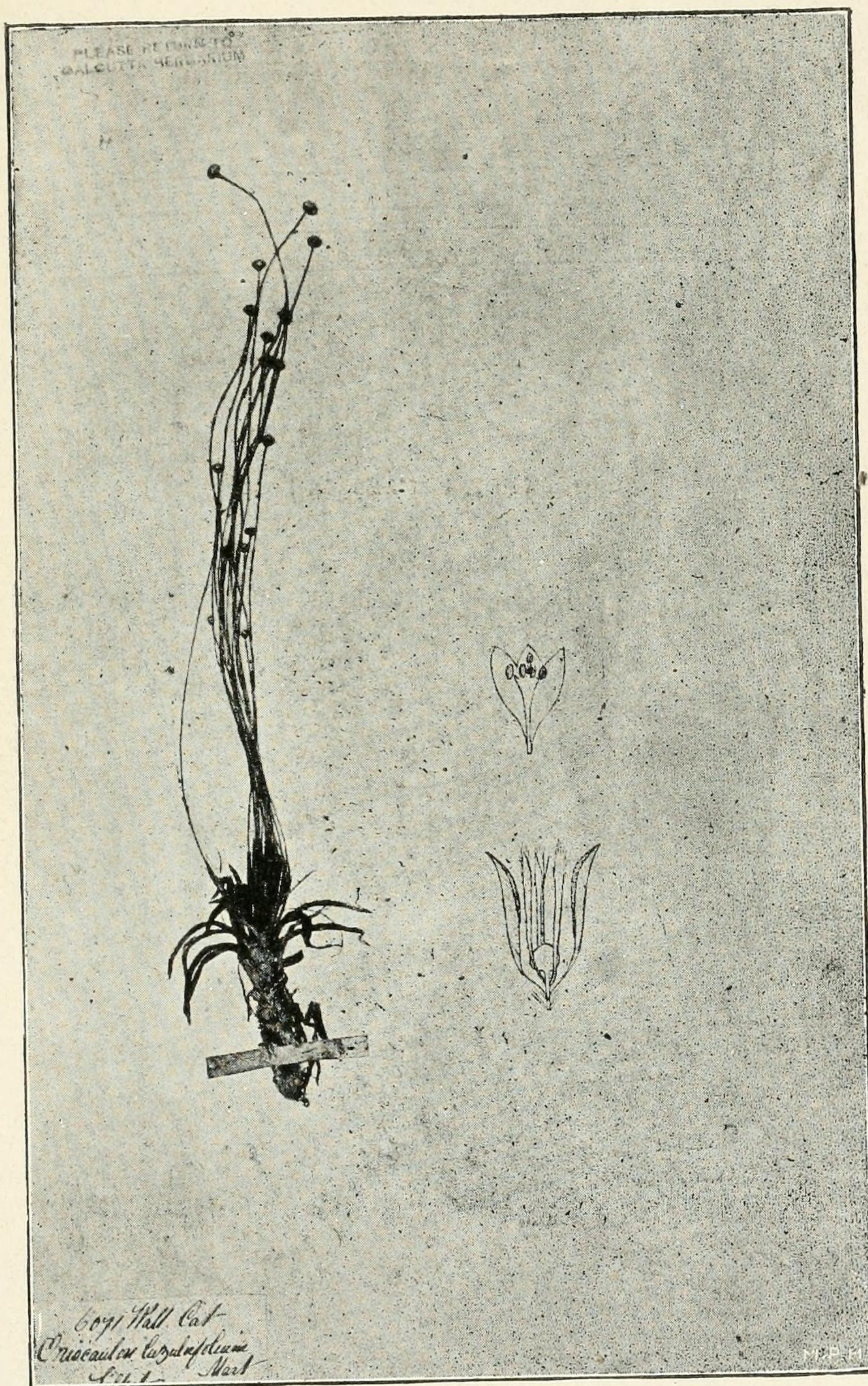
Hook. f.



ERIOCAULON DUTHIEI

Hook. f.

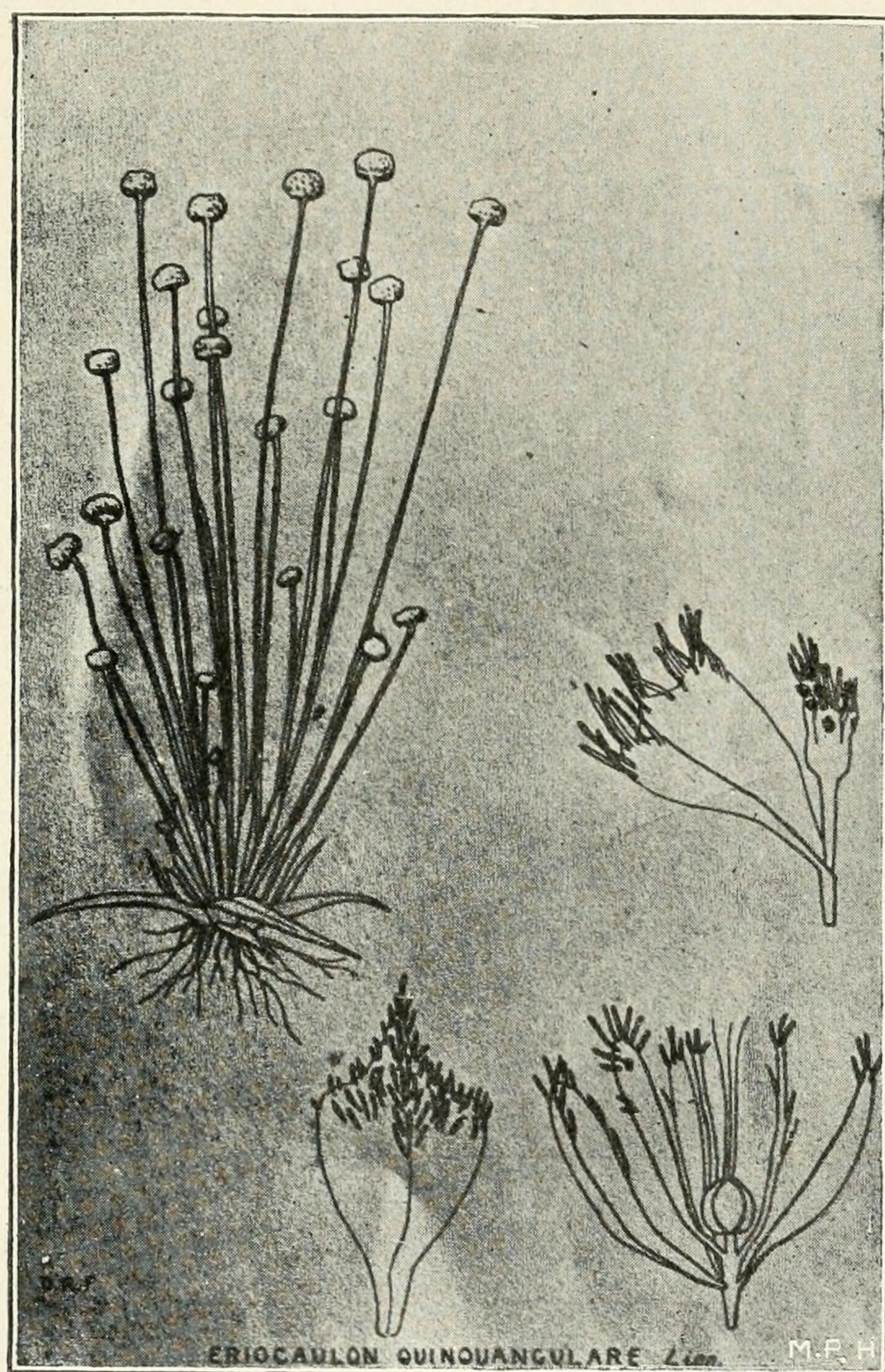
INDIAN SPECIES OF ERIOCAULON, PL. 8.



ERIOCAULON LUZULAEFOLIUM

Mart.

INDIAN SPECIES OF ERIOCAULON, PL. 9.



D. R. F. del. ERIOCAULON QUINQUANGULARE *L.*



ERIOCAULON TRILOBUM

Ham.

THE INDIAN SPECIES OF ERIOCAULON

BY P. F. FYSON, M.A., F.L.S.,

Presidency College, Madras.

(Continued from p. 207.)

✓ 20. **E. Dianae** Fyson, sp. nov. (Fyson. No. 3819 at Rudrasiri)
Caulis perbrevis. Folia lanceolata, 3-7 cm. longa, 4-6 mm. lata, plana, glabra. Pedunculi complures, 7-15 cm. aut longiores, glabra. Capitula 5-8 c.m. hemi-spherica; bractae involucrantes stramineæ and glabrae, quam capitulo longiores aut æquantes, aut demum reflexae. Bractae flores superantes obovato-cuneatae, summo-dorse puberulae, viridi nigrescentes. Flores trimeri. Flos ♂: sepala in spatham antica fissam, connata, antheræ nigrae. Flos ♀: sepala inaequalia, duo navicularia dorso puberula, unum planum, lanceolatum aut linearium, et quam ceteris brevius. Plate 11.

Peninsular India; Western Ghats from Mt. Abu and Bombay to Calicut.

I include in this species a large number of forms the extremes of which are sufficiently distinct to be considered good species, were it not for the intermediates which grade into each other, for even the 7 varieties given below are not easily separated.

* Bractae involucrantes quam capitulo longiores.

† ♀ floris tertius sepalum planum, oblanceolatum.

Var. *a typica*. Bractae involucrantes quam capitulo longiores, femini floris tertium sepalum planum. Plate 12.

Salsette to S. Kanara.

A beautiful little plant, the tips of the involucrel bracts showing beyond the margin of the head when seen from above. The head itself may be nearly flat, hemispherical, globose, or even ovoid taller than broad, depending apparently on local conditions. The third female sepal is flat but not much shorter than the others and not linear as in the other varieties. The larger heads can be distinguished only by the female sepals (the two larger being much more boat-shaped and the third flat) from *E. quinquangulare* L.

†† ♀ floris tertius sepalum linearium

Var. *b longi-bracteata*. Bractae involucrantes quam capitulo multo longiores; floris sepalum tertius latum aut linearium. Calicut. Plate 13.

Leaves 2-2½ in. by ½ in. and scapes about twice as long. Heads ¼ in. diam. with bracts spreading below over ½ in. across in all.

Corresponds to var *martiana* of *E. quinquangulare* and might be considered that plant with one sepal smaller and flat.

* * Bractae involucrantes quam capitulo nec longiores.

Var. *c parviflora*. Bractae involucrantes capitulo aequantes ; floris tertius sepalum planum aut linearium.

Coorg and N. Kanara.

The head has no rays, the bracts being short, and the flowers are much smaller than in var. *a* and *b*. Possibly a poor form of var. *a* but apparently distinct.

Var. *d Richardiana*. Planta robustior ; pedunculi 20-25 cm. ; folia 15-20 cm. ; capitula globosa ; bractae involucrantes breviores, reflexae. Plate 14.

S. Kanara.

A robust plant with globose unrayed heads. Stem $\frac{1}{4}$ in. thick and $\frac{1}{2}$ in. long. Scapes up to 14 inches very slightly pubescent in the most robust specimens. The third female sepal much shorter than the others and linear. Seeds oblong light yellow.

Var. *e* Folia quam var *a* etc. angustiora, etiam linearia ; capitula globosa, alba aut nigrescentia ; bractae reflexae.

Hills near Bombay.

Leaves acicular. Heads small, globose with reflexed bracts. connects var. *a* to the next.

Var. *f triloboides*. Capitula nigra aut nigrescentia globosa. Plate 15.

Khandala to Wynaad.

Leaves as in var. *a* Heads globose, dark almost black, distinguishable only by the third female sepal being linear from *E. trilobum* Ham. This variety has in consequence frequently been identified as that species. See p. 139, fig. 3 which is of this plant, but wrongly named *E. trilobum* on p. 150, also see p. 206.

Var. *g conica*. Capitula conica, basi truncata, folia linearia.

Mysore to Wyanaad,

Heads conical with horizontal base, very black, because nearly glabrous : clearly connected with var. *f*. This plant is possibly *E. Rouscianum* Steud : see Appendix I.

✓ 21. *E. Sedgwickii* Fyson sp. nov. (Sedgwick Nos. 4548!) 4572! 4671! 4648 ; 4847 ; 4837 ; in Herb. Pres. Coll. Madras.

Caulis perbrevis. Folia tenuia, 7-15 cm. longa, 3-5mm. lata, perpauca (?) glabra. Pedunculi 10-20 cm. glabra. Capitula globosa, nivea, valde pilosa. Bractae involucrantes nigrae, bractis flores superantibus rhombeo-cuneatae, sed albis pilis dense villosis. Receptaculum, dense-villosum. Flos ♂ ; sepala 2, angusta ; petala 3,

aequalia, glandulis magnis instructa, antherae nigrae. Flos ♀ sepala 2, angusta; petala 3, late-oblongeolata, magnis glandulis instructa. Germen tricoccum, Semina oblonga-elliptica, rubro-fusca.

Bombay, Mahabaleshwar on hill sides, on rocks, etc. Plate 16.

Remarkable for the very dense covering of white hairs on the floral bracts making the heads snow-white; and for the broad female petals and their large glands.

In general appearance and in the broad female petals the plants are often very like plants of *E. horsley-kundae* Eyson, Var *megaloccephala*, No. 47, collected by Talbot and Meebold from the Bababoodans to the Nilgiris. The female petals are like also those of *E. Geoffreyi*, *E. Collettii*, etc. where however the receptacle is glabrous. I cannot find anything in Ruhland's monograph to correspond with this and therefore suggest a new species.

III. HIRSUTAE.

Stem disciform. Leaves scapes and especially the involucre bracts hairy, rarely glabrous. Receptacle hairy. Flowers both male and female normal, (p. 148) but petals in some unequal.

About 5 species (10 in Ruhland l.c.) in India and Burma with extensions to China and Malaya possibly two in Africa.

TABLE SHOWING RELATIONSHIP AND DISTRIBUTION.

China.
—Brownianum ...	Var macrophyllum...S. Burma and Straits Settlements.
	Type.....Khasia and N. Burma.
	Var nilagirensis.....S. India and Ceylon.
—Rhodae.....	Wynaad and S. W. Mysore.
—robusto-brownianum.....	Western Mysore.
—gracile.....and Var Kurzii.....	Burma.
—Wightianum.....	Burma.
	Var Helferii.....Andamans.
—lanceolatum.....	S. India on West Coast.

Key to the Hirsutae.

* Bracts of the involucre black, or brownish at the base. Heads 1/3-1 inch diam.

Floral bracts acuminate, hairy, giving the head an echinate appearance (W. Ghats). 23 robusto-brownianum.

Floral bracts dirty white, nearly glabrous. (W. Ghats. of Mysore and Wynaad). 25 E. Rhodae.

Floral bracts black, hairy acute. (Khasia and North Burma, S. India Mountains, Malay and China) ... 22 *E. Brownianum*.

** Bracts of the involucre pale, straw-coloured when dry.

Scapes to 20 in.; heads $1\frac{1}{2}$ in.; female sepals unequal, visible beyond the floral bracts. (Malabar) ... 27 *E. lanceolatum*.

Scapes 6-10 in.; heads $\frac{1}{4}$ to $\frac{3}{4}$ in.; female petals clawed; floral bracts white, outer nearly glabrous. (Burma and Andamans) ... 26 *E. Wightianum*.

Scapes 8-12 in.; female petals oblanceolate, without glands; floral bracts blackish... 24 *E. gracile*.

22. *E. Brownianum* Mart. (Wall. Cat. 6066 in Herb. Calc!); F.B.I. vi, 576, No. 18; Ruhl. No. 117 and *E. nilagirens* No. 93. Leaves narrow about $\frac{1}{4}$ in. wide and 15-20 in. long, glabrous or hairy, as also the scapes which are about as long. Heads $1\frac{1}{3}$ — $1\frac{1}{2}$ in. Involucre pale, glabrous or hairy. Female flower—Sepals dark, deeply boat-shaped. scabrid on the keel. Petals narrow, with long hairs and large glands. Seeds oval, dark brown. Plate 17.

Var. *a typica* leaves and involucre often (but not always) glabrous, Assam; Silhet (type), Khasia; Burma; Manipur.

Var. *b nilagirens* Steud. Whole plant hairy and more robust than the type. Leaves usually shorter and broader, but sometimes narrow. Scapes stout and hairy. Heads 1 inch flat or hemispheric. Involucre black, hairy. Female flower:—Sepals less deeply boatshaped. Petals a little broader; otherwise as in the type. See Fig. p. 263.

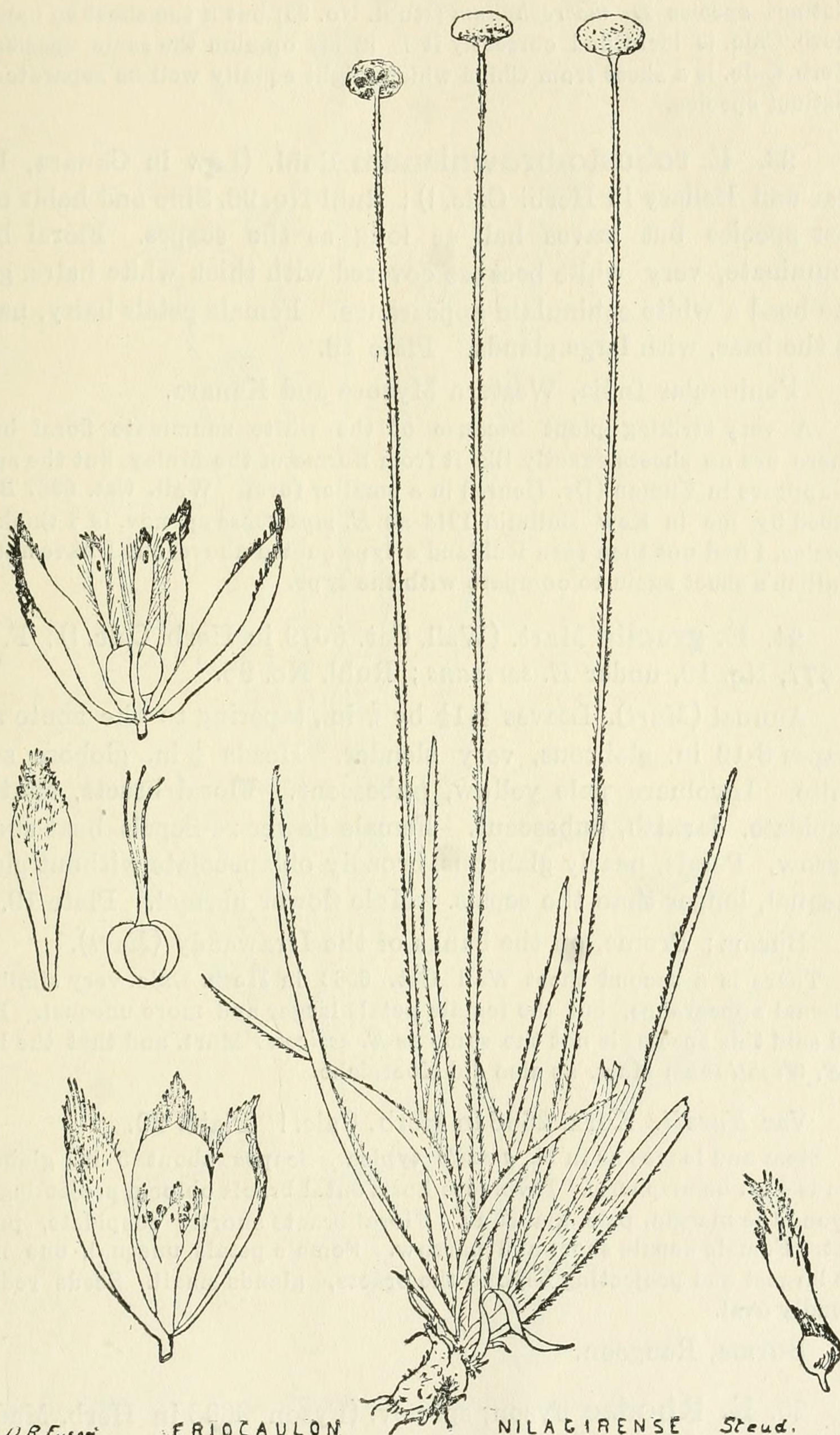
S. India and Ceylon at high elevations.

Very common in semi-dry or marshy land at about 7000 ft., forming usually dense tufts a foot or more across. The flowers smell strongly of honey and are visited by small butterflies. The name suggests that this is a variety confined to these regions, but in Herb. Calcutta are sheets from Khasia hardly if at all different. Hooker was the first I think to reduce Steudel's species to *E. Brownianum* Mart. Koerniche considered it closest to *E. Wightianum*.

Var. *c macrophyllum* Ruhl. lc. No. 95.

Malay Peninsula.

Var. *b* was founded by Steudel as a distinct species, but reduced by Hooker to *E. Brownianum*. It was restored to specific rank by Ruhl and because the type has glabrous involucre is separated in his clavis by 24 species.



URFyson ERIOCAULON NILAGIRENSE Steud.

ERIOCAULON BROWNIANUM Mart.
Var. nilagirense.

Ruhland described (lc. p. 77) the Malay Peninsula form (var. *c*) as a distinct species *E. macrophyllum* (Ruhl. No. 95) but if the sheet so named in Herb. Calc. is identified correctly it is in my opinion the same species. In Herb. Calc. is a sheet from China which might equally well be separated as a distinct species.

23. ***E. robusto-brownianum*** Ruhl. (Law in Canara, Dharwar and Bellary in Herb. Calc. !); Ruhl No. 96. Size and habit of the last species but leaves half as long as the scapes. Floral bracts acuminate, very white because covered with thick white hairs, giving the head a white echinulate appearance. Female petals hairy, narrow at the base, with large glands. Plate 18.

Peninsular India, Western Mysore and Kanara.

A very striking plant because of the white acuminate floral bracts. There are no sheets exactly like it from Burma of the Malay, but the species re-appears in Yuman (Dr. Henry) in a smaller form. Wall. Cat. 6967 B, described by me in Kew Bulletin 1914 as *E. mysorensis* sp. nov. is I think this species. I had not then seen Ruhland's type quoted above, but I have not seen Wallich's sheet again to compare with the type.

24. ***E. gracile*** Mart. (Wall. Cat. 6079 in Herb. Calc. !); F. B. I. vi 577, No. 19, under *E. sericans*; Ruhl. No. 98.

Annual (*Mart*). Leaves $\frac{1}{2}$ - $1\frac{1}{4}$ by $\frac{1}{8}$ in., tapering to the acute apex. Scapes 8-12 in. glabrous, very slender. Heads $\frac{1}{4}$ in. globose snow-white. Involucre pale yellow, pubescent. Floral bracts, acute or cuspidate, darkish, pubescent. Female flower:—Sepals boat-shaped, narrow. Petals, nearly glabrous, broadly oblanceolate without glands, unequal, longer than the sepals. Male flower normal. Plate 19.

Burma; Prome, on the banks of the Irrawaddy (*Mart*).

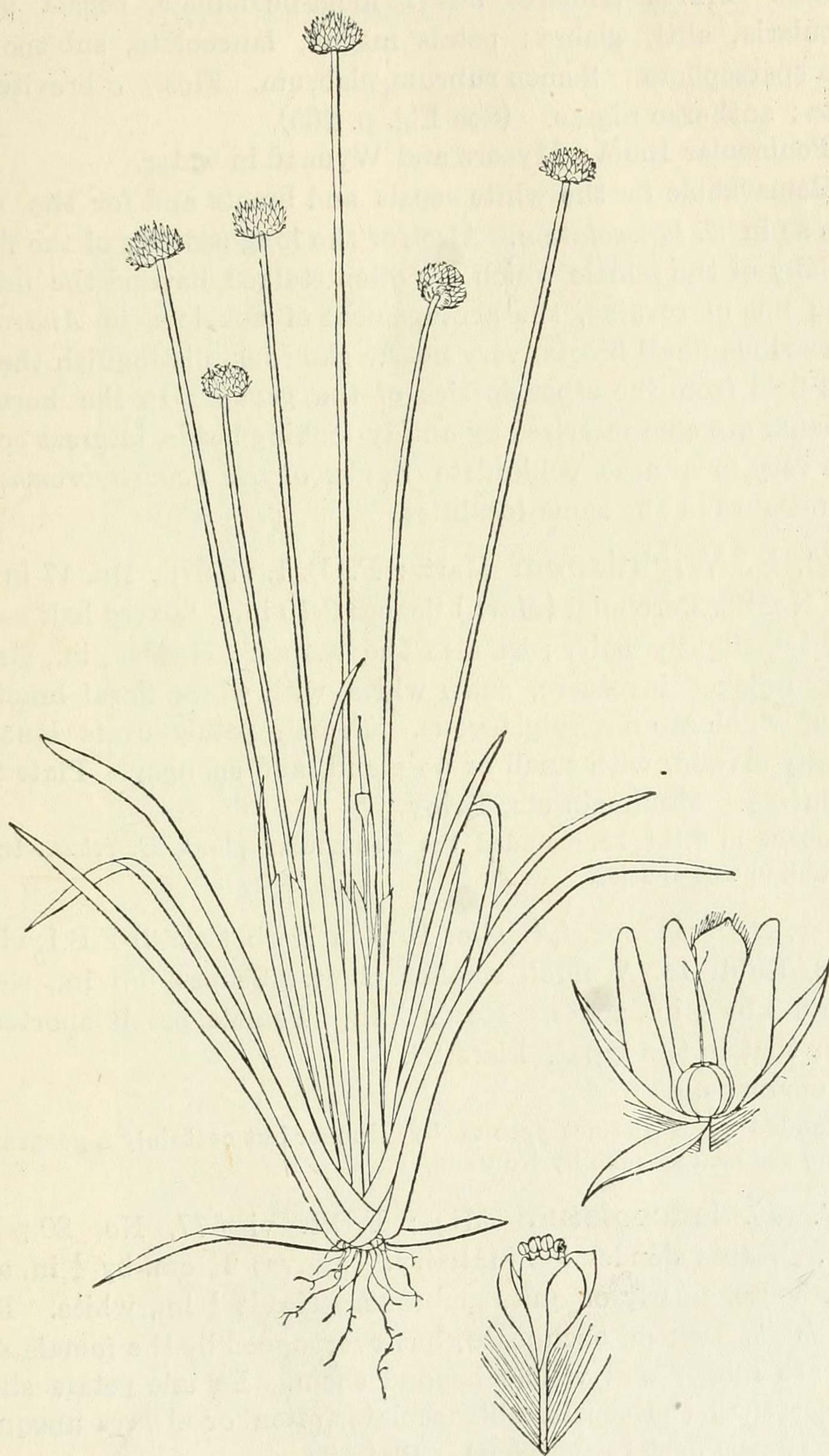
There is a second sheet Wall Cat. 6082 in Herb. Calc. very similar in external appearance, but the female petals larger and more unequal. Ruhl- and said this species is not the same as *E. sericans* Mart. and that the latter is *E. Wightianum* Mart. as also did Koerniche.

Var *Kurzii*. Kurz. 2638 in Herb. Calc. ! Plate. 20.

Stem and leaves as in *E. gracile* typica. Scapes about 5 in. glabrous. Heads $\frac{1}{2}$ in. hemispheric. Involucre horizontal bracts oblong, projecting well beyond the margin, pale, glabrous. Floral bracts shortly cuspidate, pubescent. Female sepals short and narrow. Female petals unequal, one much the largest and projecting beyond the bracts, glands small. Seeds reddish, broadly oval.

Burma, Rangoon.

25. ***E. Rhodae*** Fyson, sp. nov. (Fyson 9696 in Herb. Madras) Caulis perbrevis. Folia iisdem sp. *E. nilagirensis* similes Pedunculi plures 15-30 cm. Capitula globosa 1.2-2 cm. Bractae involucrantes reflexae. Bractearum flores superantium inferiores albae, acutae;



D. R. Fyson del.

ERIOCAULON RHODÆ Fyson.

superiores quomodo nigrescentes, dorso pubescentes. Receptaculum villosum. Flores trimeres flos ♀ longi-pedicillata, sepala æqualia, navicularia, alba, glabra; petala magna, lanceolata, sub-spongiosa, dorso sparsepilosa. Semen rubrum, glabrum. Flos ♂ breviter pedicellata; antherae nigrae. (See Fig. p. 265).

Peninsular India; Mysore and Wynaad in water.

Remarkable for the white sepals and bracts and for the stalked petals as in *E. lanceolatum*. Also for the long-pedicels of the flowers, especially of the female which are often stalked beyond the male recalling but in reverse, the arrangement of spikelets in *Andropogon*. The scarious floral bracts, very nearly glabrous, distinguish the plant in the field from the other species of the group. In the herbarium the plants are characterised by untidy-looking heads, in great contrast to the very firm neat echinulate heads, of *E. robusto-brownianum*, which occurs in the same localities.

26. **E. Wightianum** Mart.; F. B. I. vi 576, No. 17 in part; Ruhl. No. 92. Perennial (*Mart.*) Scapes 6-10 in. Leaves half as long, by $\frac{1}{2}$ - $\frac{3}{4}$ in., slightly hairy; as also the scapes. Heads $\frac{1}{2}$ in., globular by the reflexed involucre, snow white, with white floral bracts, the lower of which are nearly glabrous. Female petals ovate lanceolate distinctly clawed, with small or no gland, and spongy. Plate 21.

Burma. Moulmein etc, Tavoy.

Hooker in F.B.I. l.c. included the Peninsular plant, *E. robusto-brownianum* Ruhl. in this species.

Var. *Helferi* Hook. f. (Helfer 1584 in Herb. Calc.!) F.B.I. vi, 583 No. 38, Ruhl. 1c. A much smaller plant. Scapes 5-8 in., slender. Leaves 2-3 by $\frac{1}{4}$ in., acute. Heads $\frac{1}{4}$ in. Female petals shorter and broader than in the type. Plate 22.

Andamans.

Founded as a distinct species by Hooker but certainly a geographical form and reduced as such by Ruhl. and.

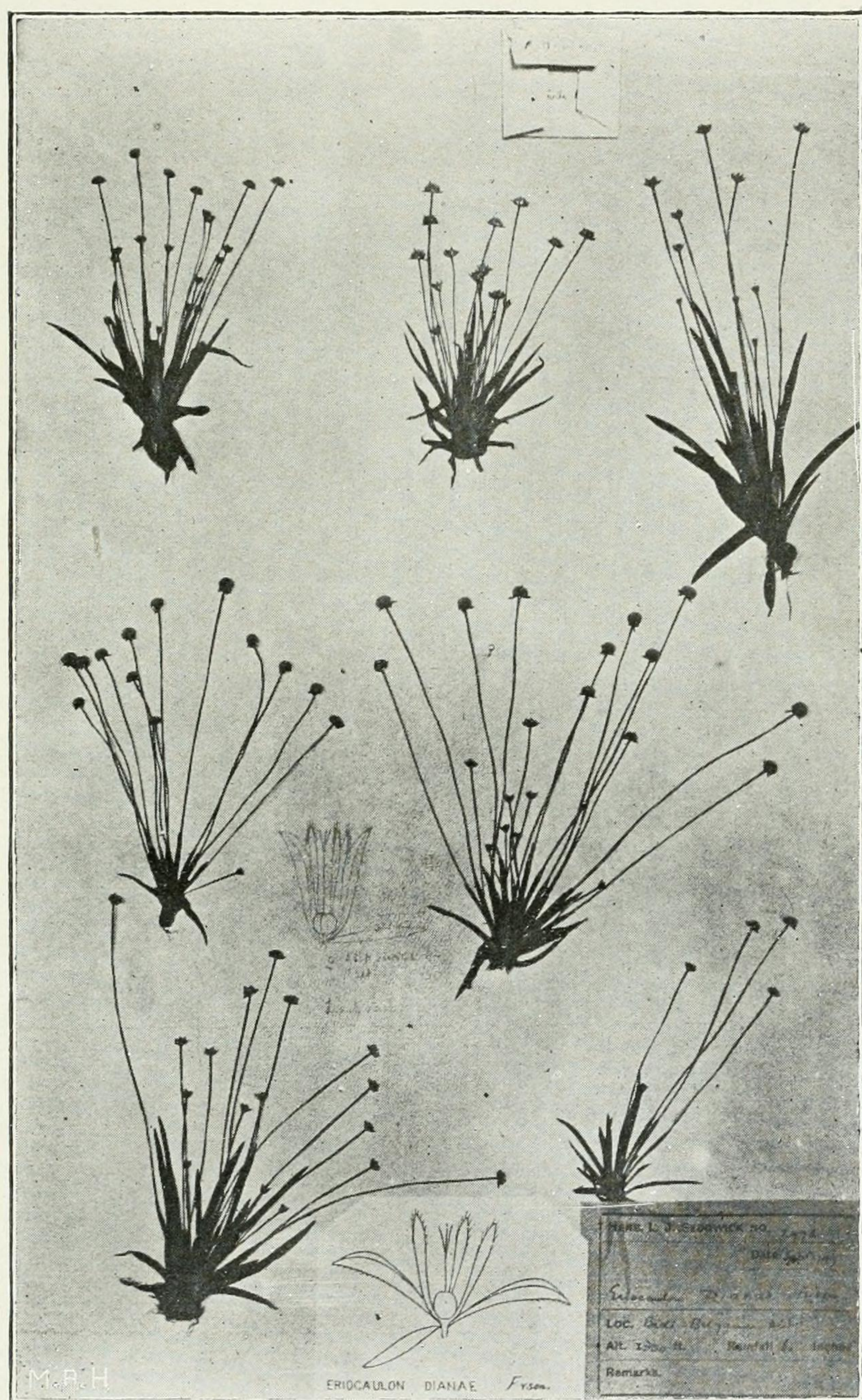
27. **E. lanceolatum** Miq.; F.B.I. vi 577, No. 20; Ruhl, No. 99. Scapes slender 5-6 in. hairy. Leaves $2\frac{1}{2}$ cm. by $\frac{1}{4}$ in. at the widest, acute, nearly or quite glabrous. Heads $\frac{1}{4}$ in., white. Floral bracts short, darkish, obcuneate, but overtopped by the female sepals which are longer and visible beyond them. Female petals shorter or longer than the sepals, oblanceolate, often or always unequal in length. Seeds dark brown, oval. Plate 23.

Western Peninsular on the Malabar Coast.

Remarkable for the glabrous conspicuous sepals.

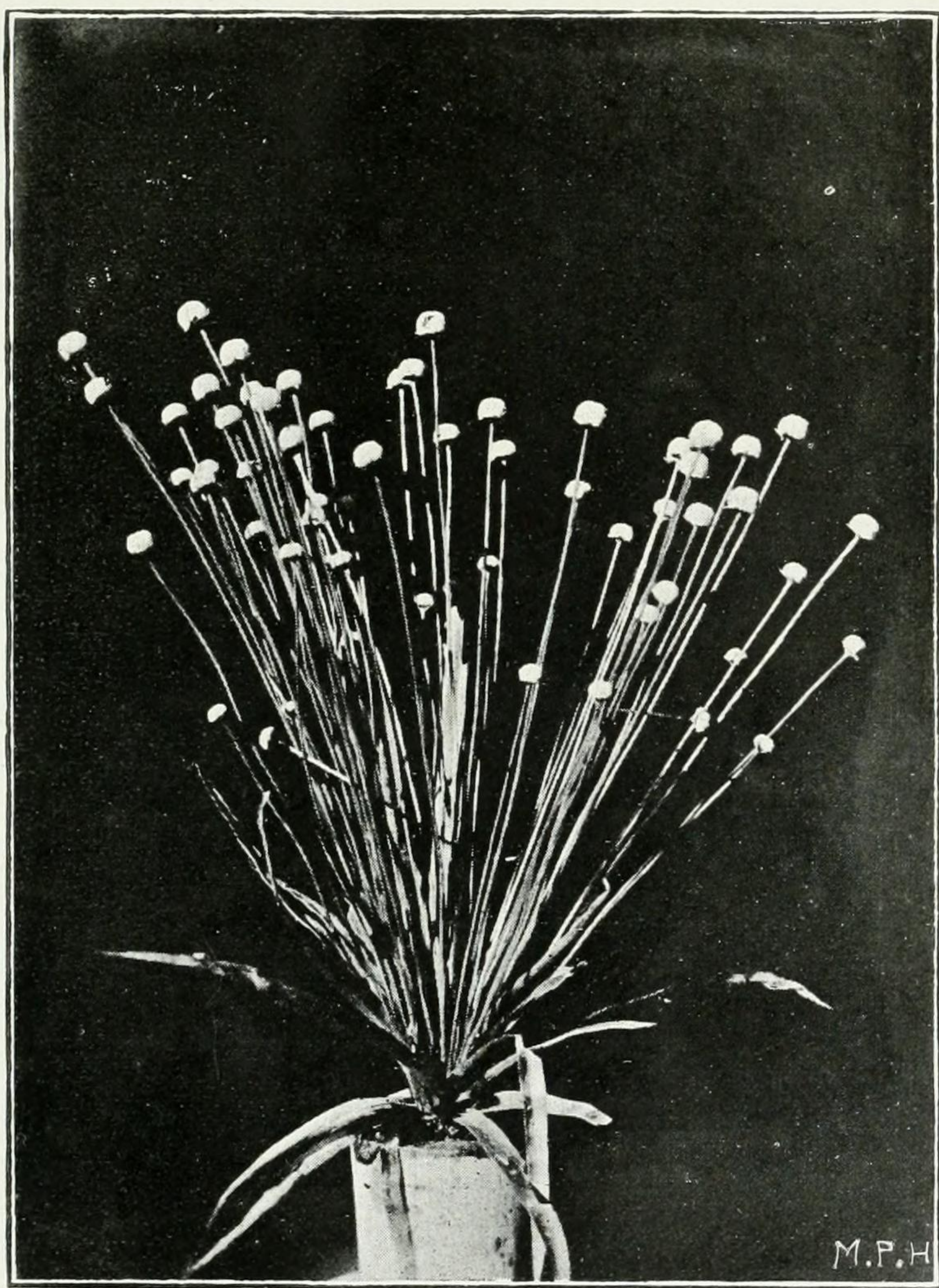
(To be Continued).

INDIAN SPECIES OF ERIOCAULON, PL. 11.



ERIOCAULON DIANAE *Fyson.*

INDIAN SPECIES OF ERIOCAULON, PL. 12



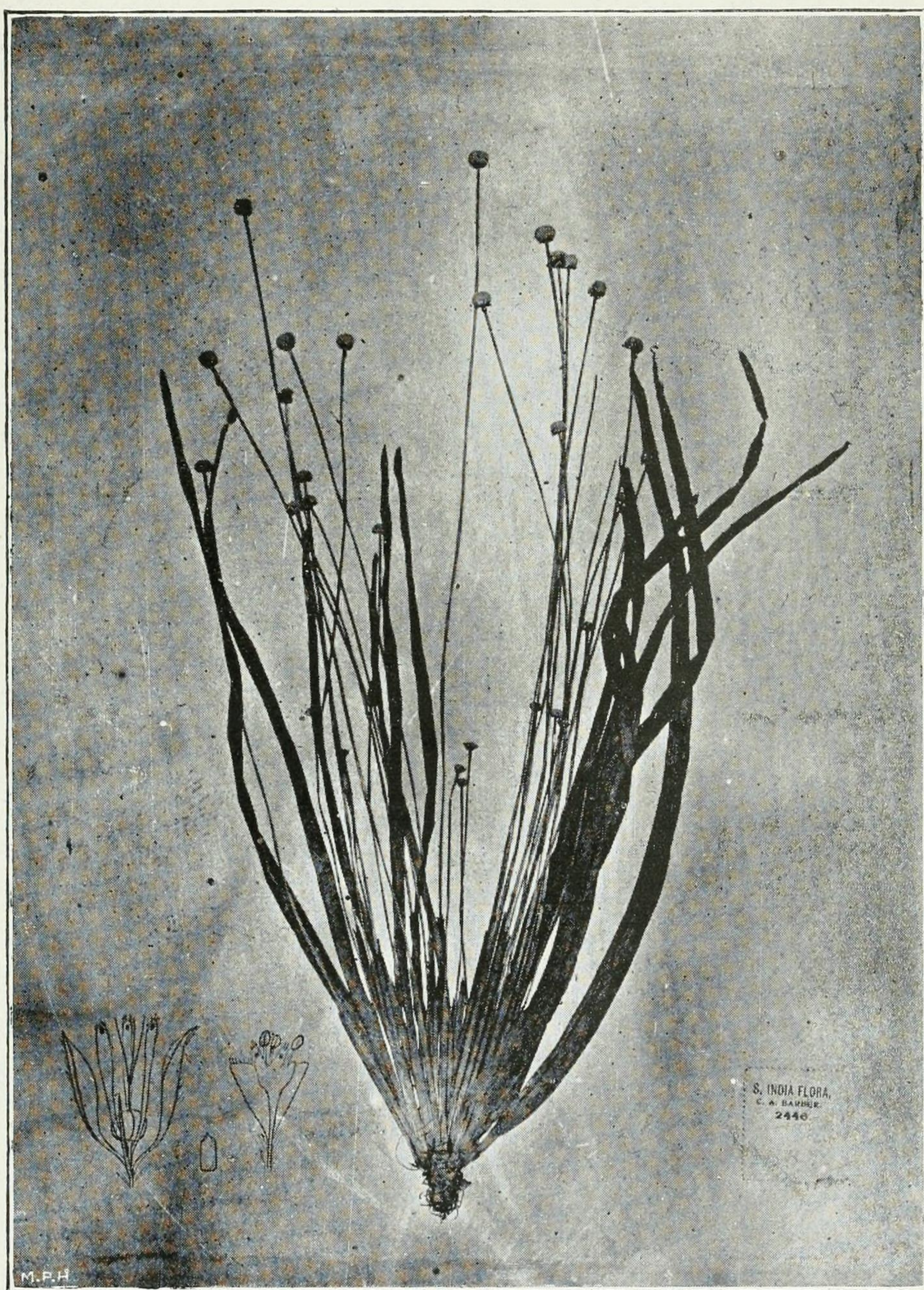
ERIOCAULON DIANAE *Fyson.*
Var. *typica.*

INDIAN SPECIES OF ERIOCAULON, PL. 13.



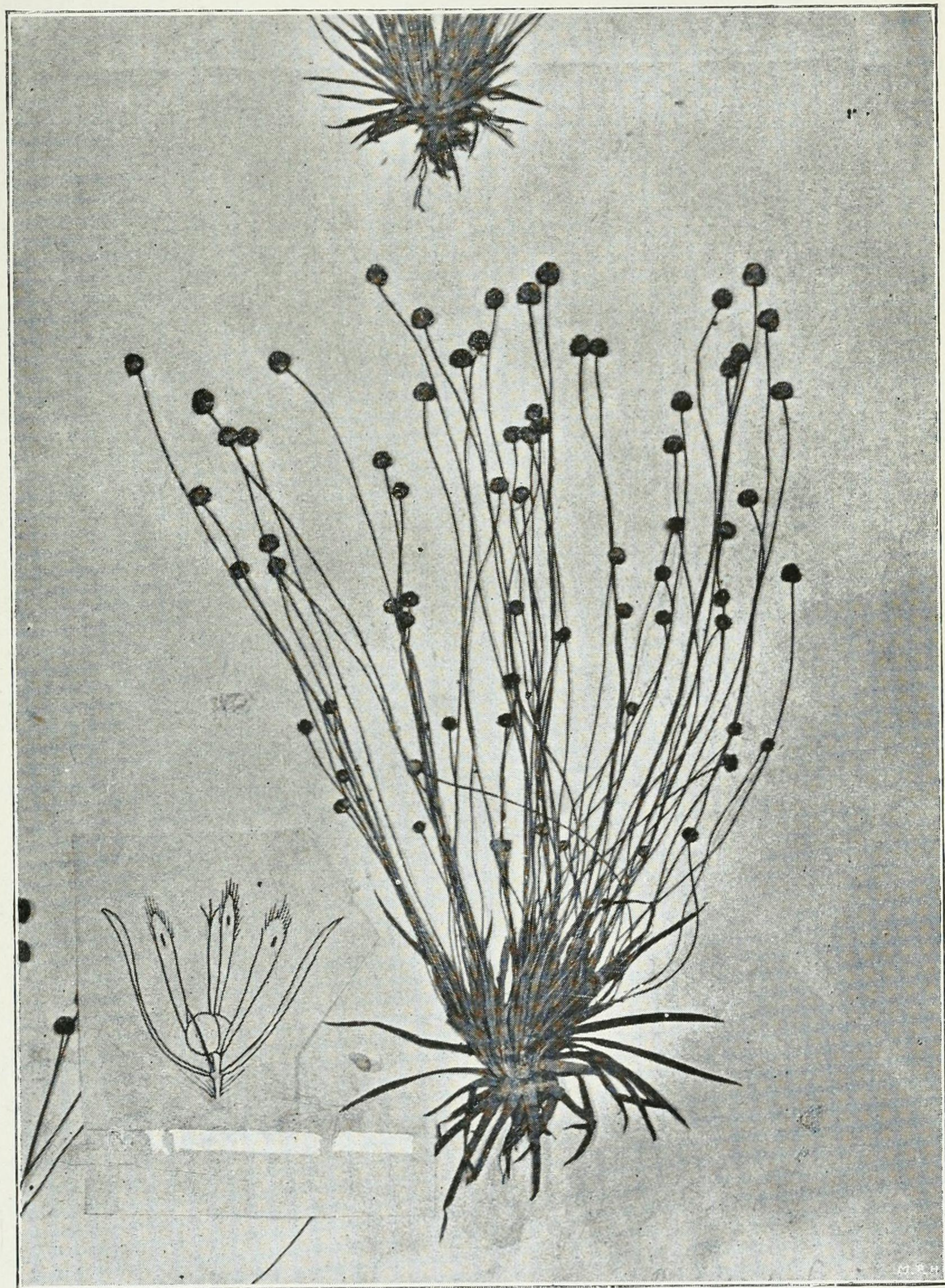
ERIOCAULON DIANAE *Fyson.*
Var. *longibracteata*

INDIAN SPECIES OF ERIOCAULON, PL. 14.



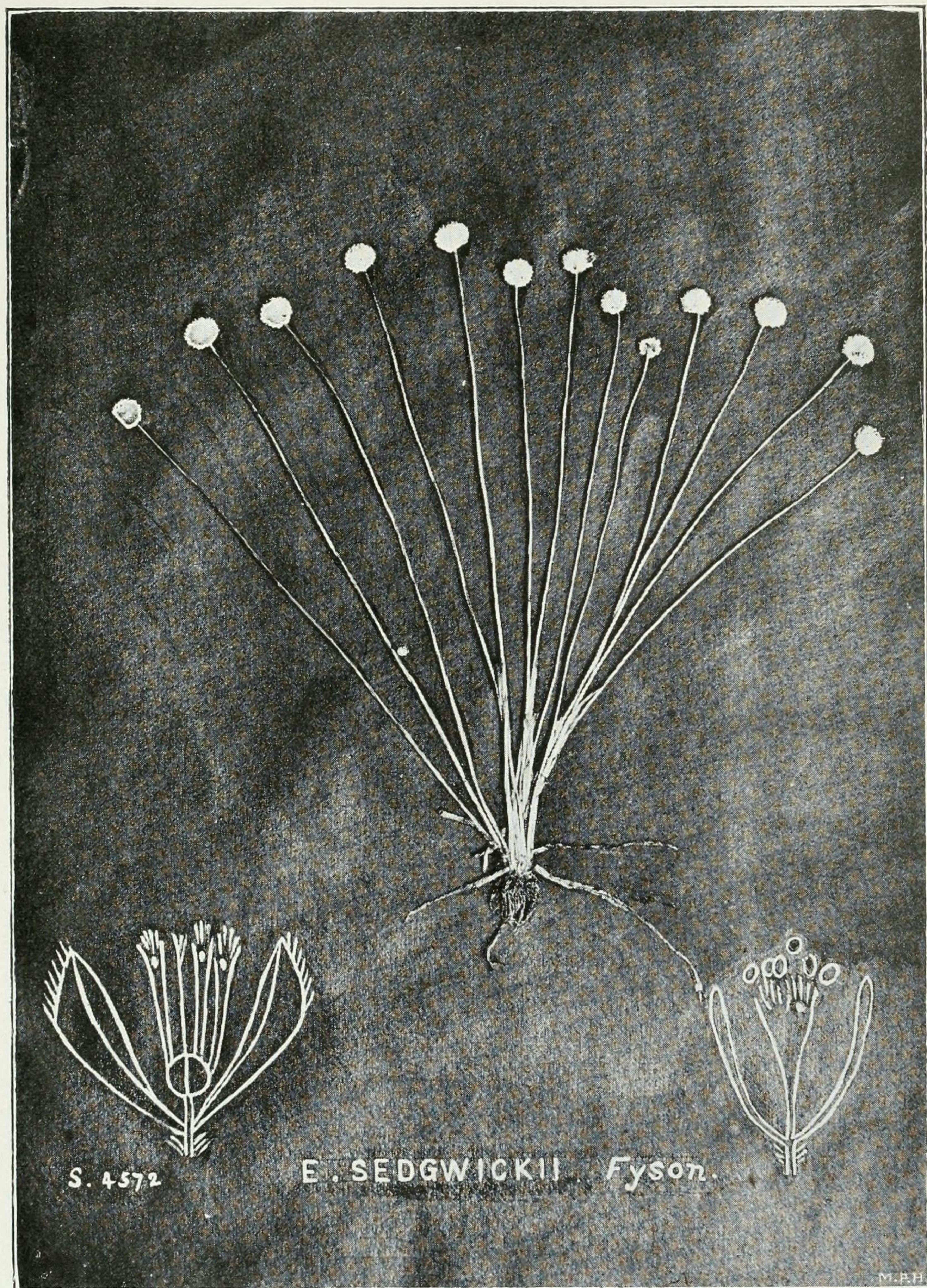
ERIOCAULON DIANAE *Fyson*
Var. *Richardiana*

INDIAN SPECIES OF ERIOCAULON, PL. 15.



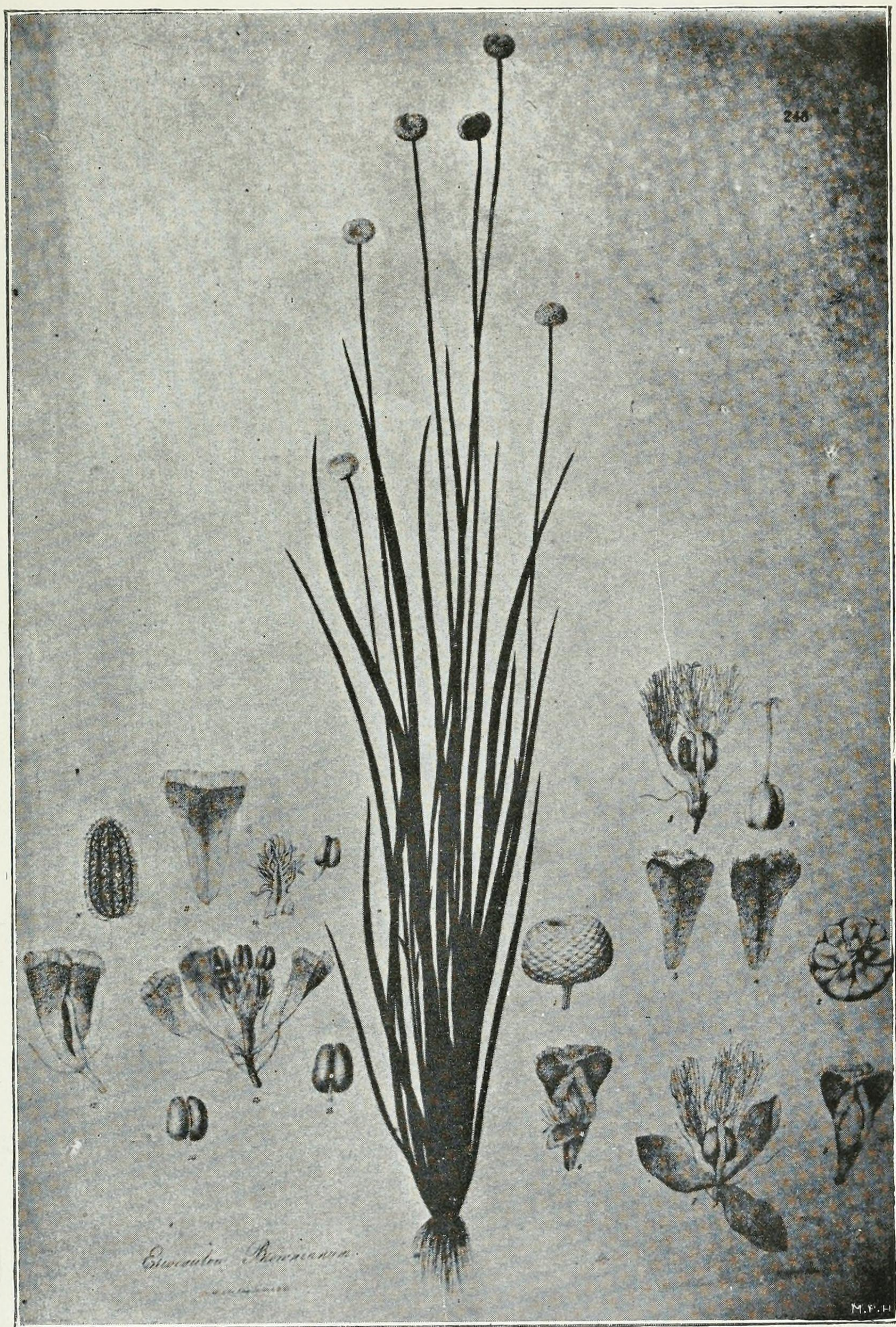
ERIOCAULON DIANAE *Fyson.*
Var. *triloboides.*

INDIAN SPECIES OF ERIOCAULON, PL. 16.



ERIOCAULON SEDGWICKII *Fyson.*

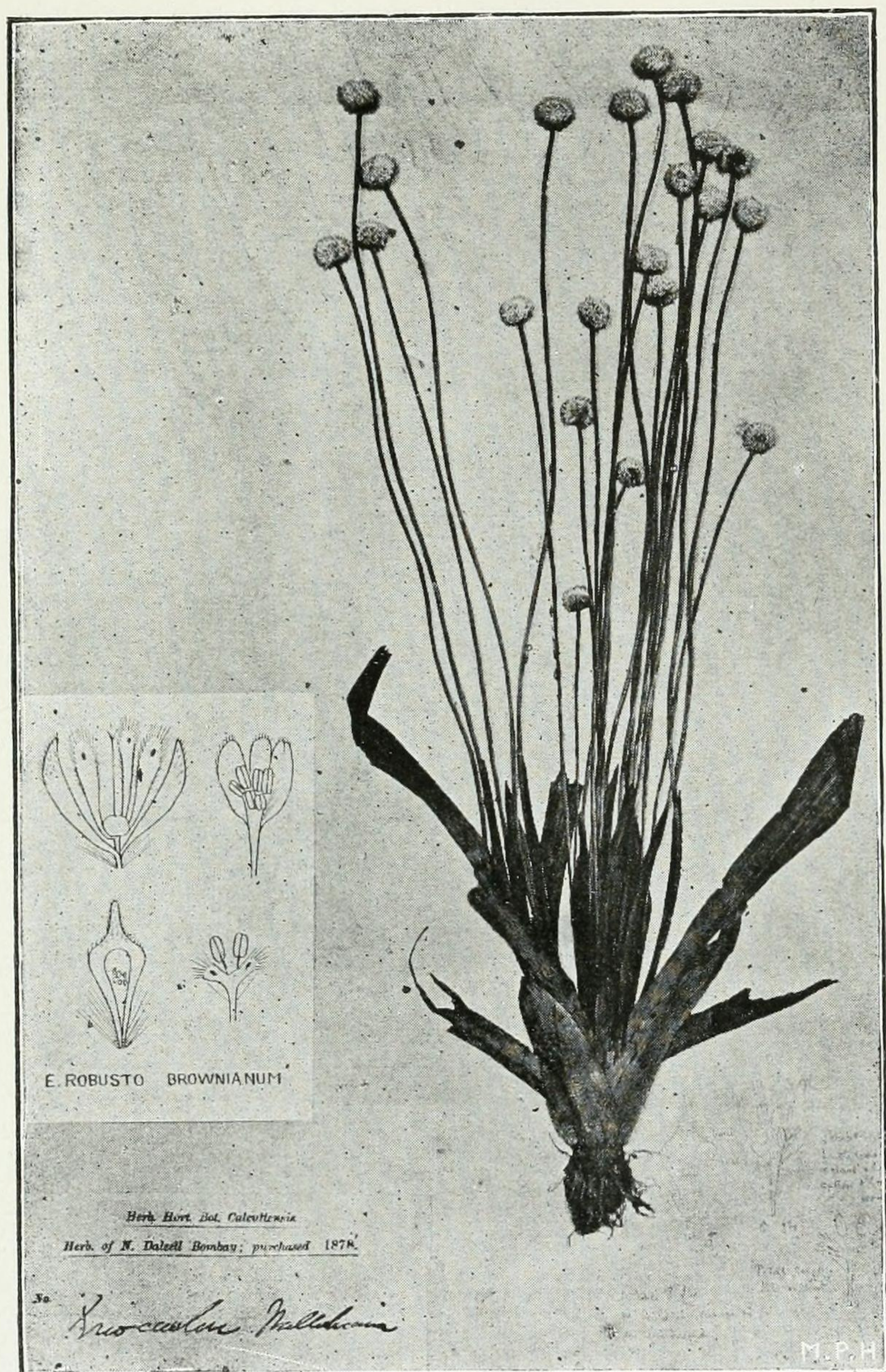
INDIAN SPECIES OF ERIOCAULON, PL. 17.



ERIOCAULON BROWNIANUM *Mart.*

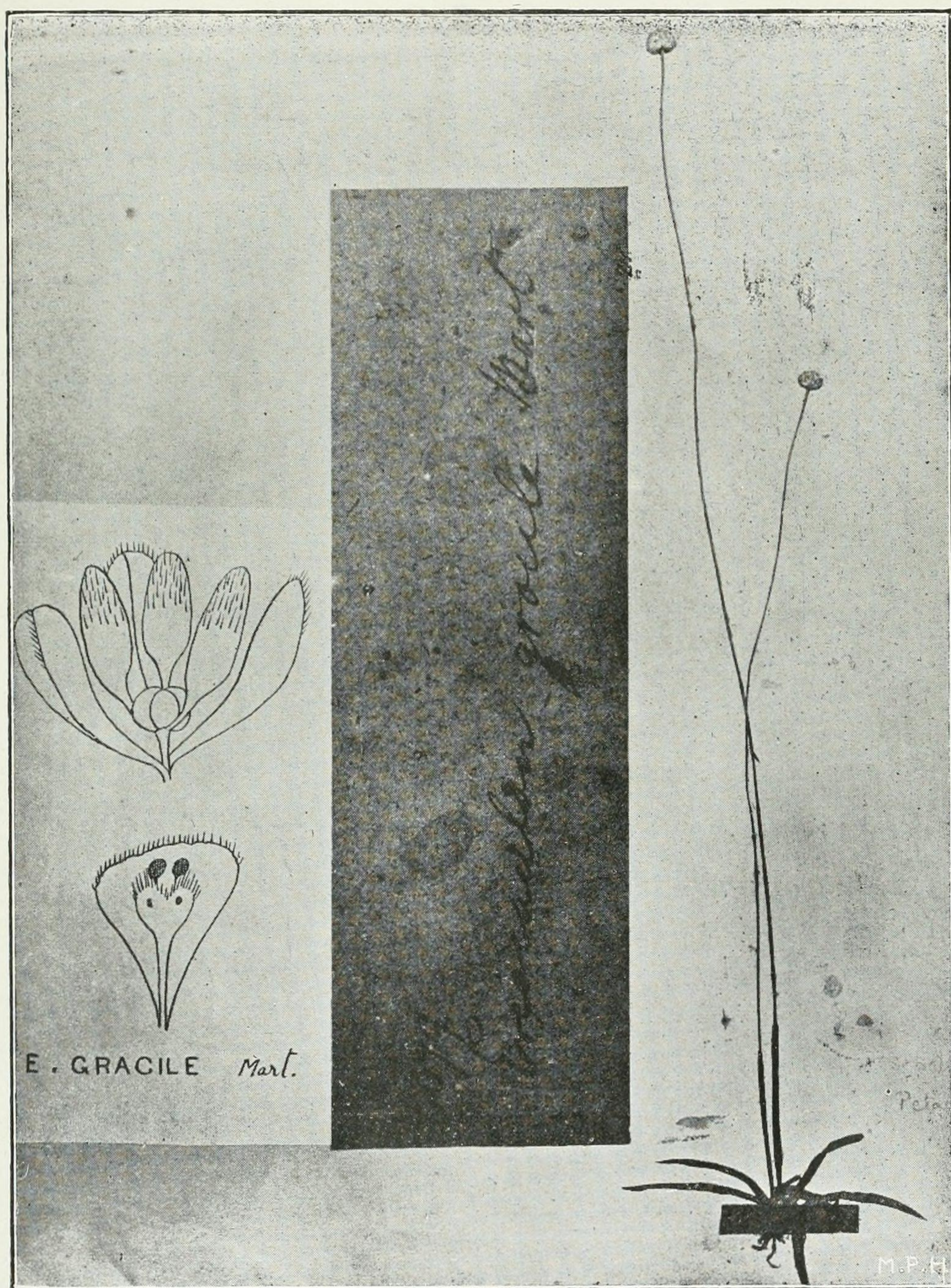
From a photograph of plate in Wallich's *Plant. Rari. Asiaticae*, Vol. III.

INDIAN SPECIES OF ERIOCAULON, PL. 18.



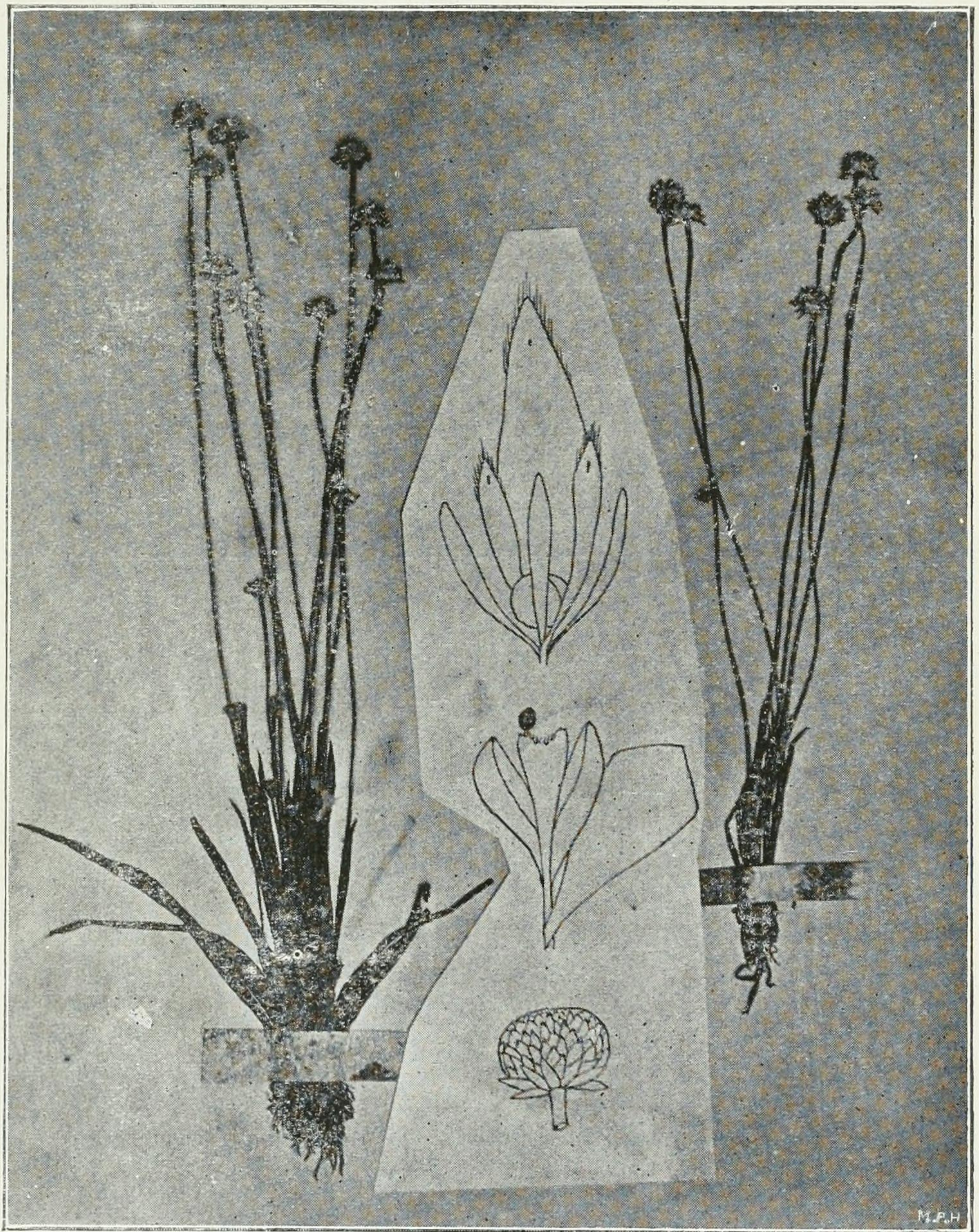
ERIOCAULON ROBUSTO-BROWNIANUM Ruhl.

INDIAN SPECIES OF ERIOCAULON, PL. 19.



ERIOCAULON GRACILE Mart.

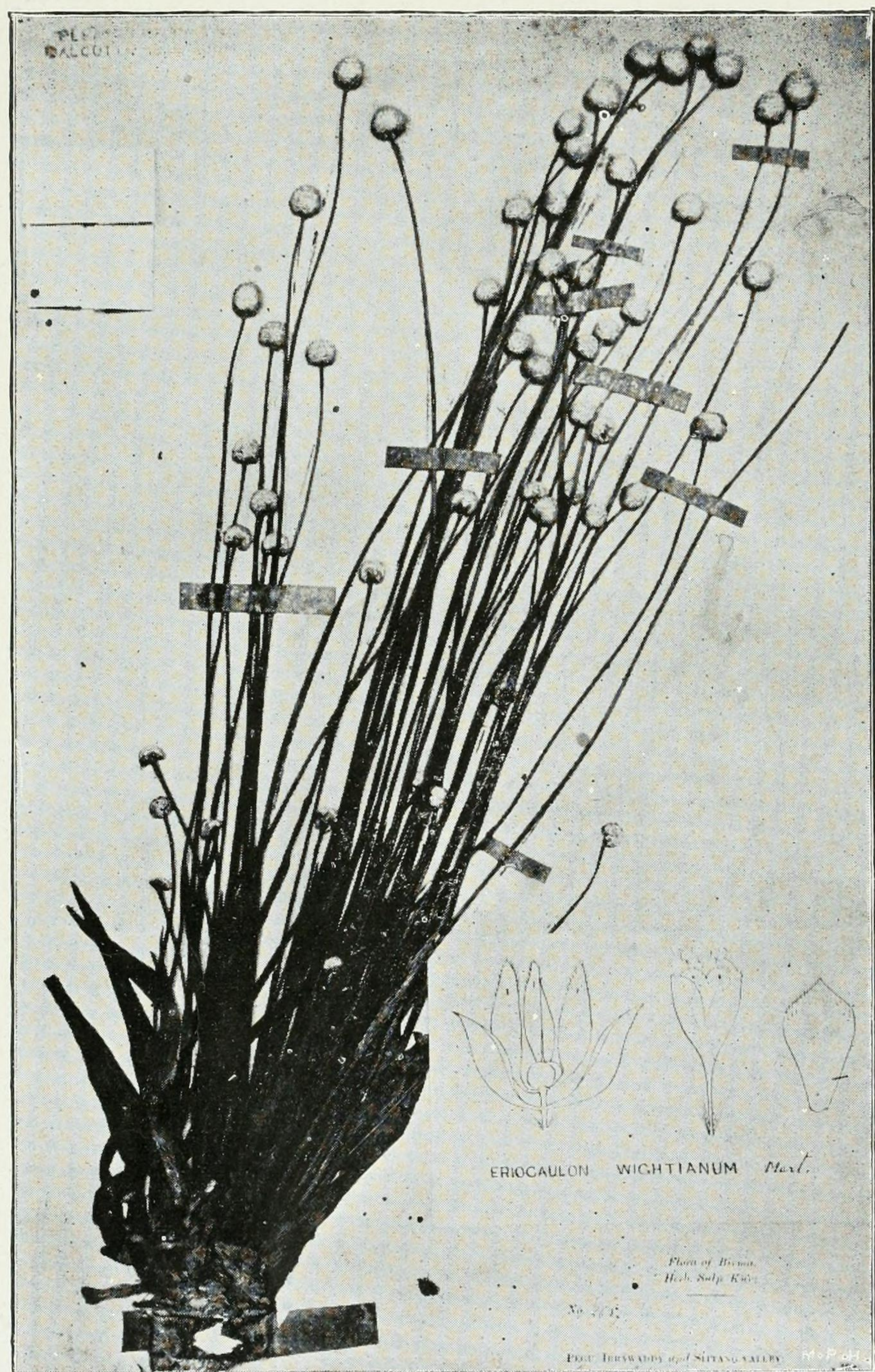
INDIAN SPECIES OF ERIOCAULON, PL. 20.



ERIOCAULON GRACILE *Mart.*

Var. *Kurzii.*

INDIAN SPECIES OF ERIOCAULON, PL. 21.



ERIOCAULON WIGHTIANUM Mart.

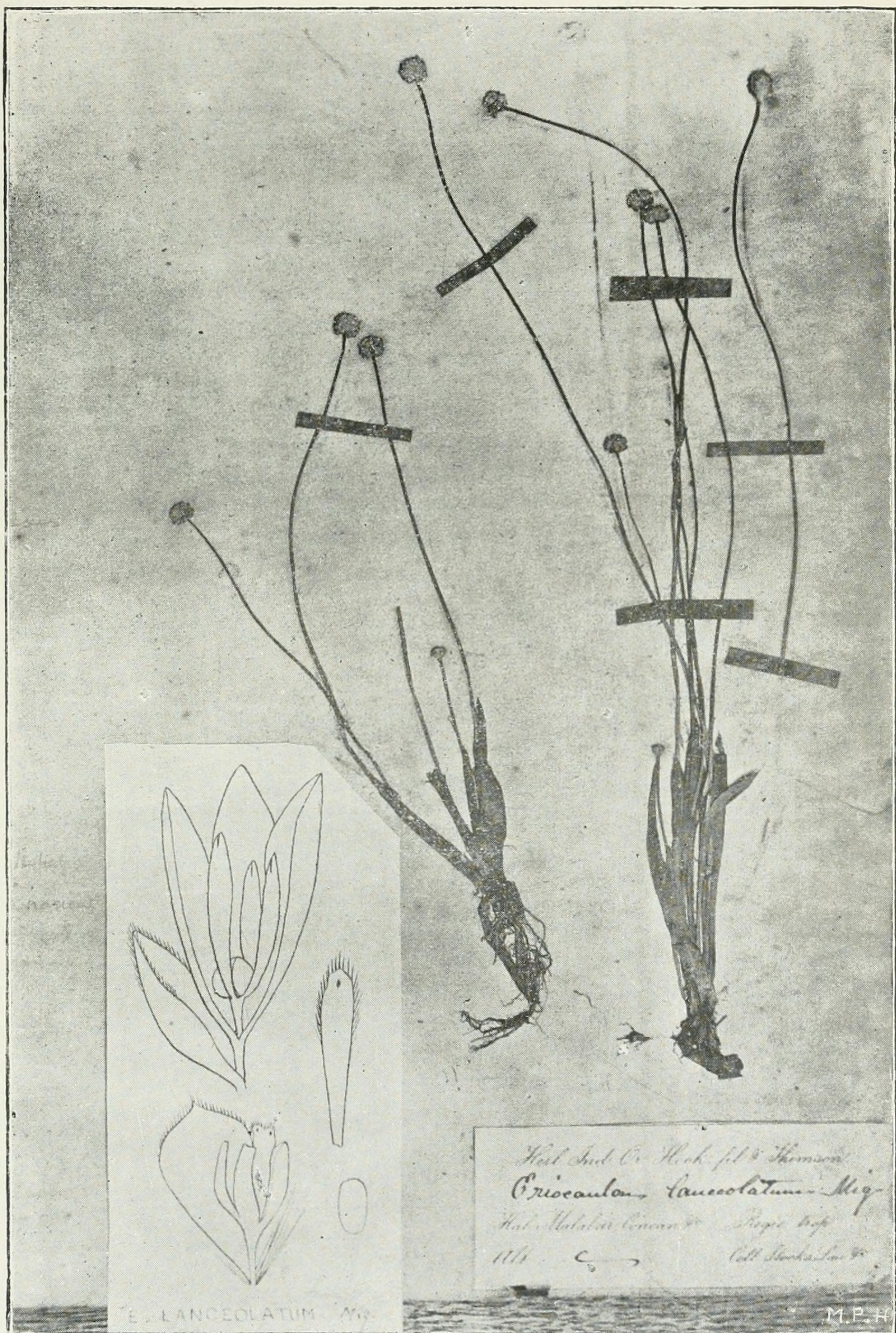
The third sepal is not shown in the female flower.

INDIAN SPECIES OF ERIOCAULON, PL. 22.



ERIOCAULON WIGHTIANUM Mart.
Var. Helferi.

INDIAN SPECIES OF ERIOCAULON, PL. 23.



ERIOCAULON LANCEOLATUM Miq.

THE INDIAN SPECIES OF ERIOCAULON

BY P. F. FYSON, M.A., F.L.S.,

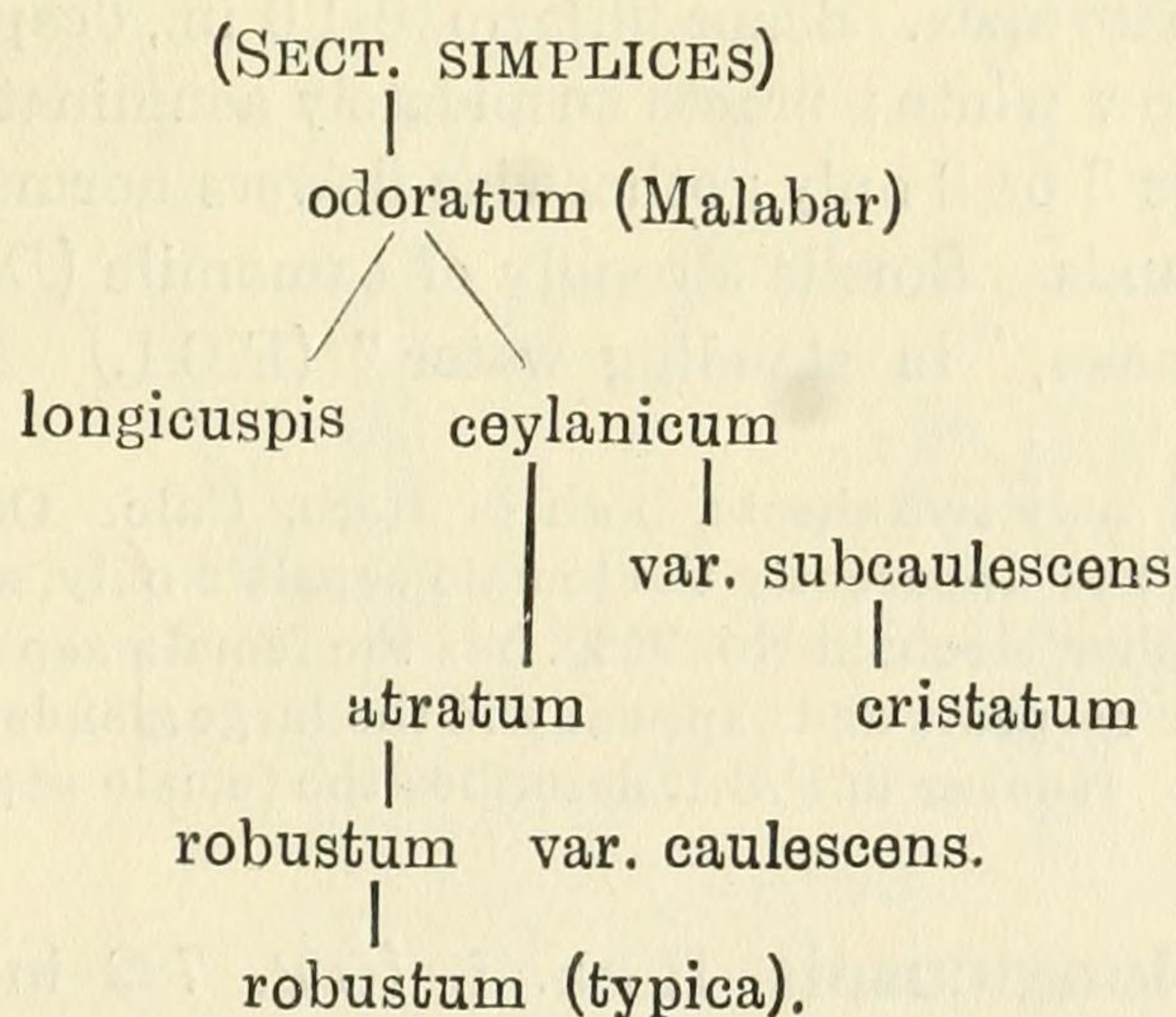
Presidency College, Madras.

(Continued from p. 266.)

IV. ANISOPETALAE.

The male flowers have one petal much enlarged and projecting beyond the floral bracts, covering them : in the larger species this petal has a very conspicuous black gland. Otherwise the flowers are normal : the male calyx united as a spathe split in front ; the anthers black ; the female flowers with three more or less boat-shaped sepals and three oblanceolate somewhat hairy petals. The stem is occasionally elongate, and even branched and suffrutescent. The heads are mostly semi-globular, with a convex, sometimes tall, hairy receptacle. The leaves are glabrous, and in most species characteristically thick and glossy. The involucral bracts may be dark or pale, even in the same species.

TABLE OF PROBABLE RELATIONSHIPS.



The series seems to start with *E. odoratum*, or perhaps *E. longicuspis*, and to connect with the SIMPLICES through *E. collinum*. It is chiefly developed in Ceylon, where the several species of other authors, *subcaulescens*, *ceylanicum*, *atratum* and *sub-glaucum*, are distinguishable, if the sheets in the Ceylon Herbarium are rightly so named, by characters of only minor importance, and lead by hardly more than increase in size and general robustness to *E. caulescens* Hook. f. ; which again differs only in being branched from *E. robustum*

of the Nilgiris, an older species, to which therefore I reduce it. There is no difference except in the number of scapes between *E. policephalum* Hook. f. of Central India and *E. longicuspis* Hook. f. of Ceylon.

Key to the Anisopetalae.

* Heads $1/6$ - $1/4$ in. diam.

Ls. $1-1\frac{1}{2}$ in., lanceolate; scapes 6-10 in.

(Malabar) ... 28 *E. odoratum*

Ls. $2\frac{1}{2}$ -3 in., linear from a broad base;

(scapes 12-18 in Khasia) ... 33 *E. cristatum*.

* * Heads $1/4$ - $1/2$ in. diam.

Floral bracts acuminate (Central India and Ceylon) ...

29 *E. longicuspis*.

Floral bracts not acuminate (Ceylon)—

Involucre black ... 30 *E. atratum*.

Involucre white ... 31 *E. ceylanicum*.

* * * Heads $1/2$ —1 in. diam.

Stem stout, short or caulescent (S. India and Ceylon) ...

32 *E. robustum*.

28. *E. odoratum* Dalz. F.B.I. vi. 574, No. 9; Ruhl. No. 187. Stem disciform. Leaves 1-3 in, by $1/8$ in. at the base, and narrowed to the acuminate apex. Scape filiform, 6-10 in., deeply grooved. Heads $1/6$ - $1/4$ in. snow white; bracts cuspidately acuminate. Sepals of the female flowers 3 or 2 only; otherwise flowers normal. Female petals with large glands. Smells strongly of camomile (*Dalz*). Plate 24.

The Concan, "in standing water" (F.B.I.) Malabar, ft. Sept. (*Dalz*).

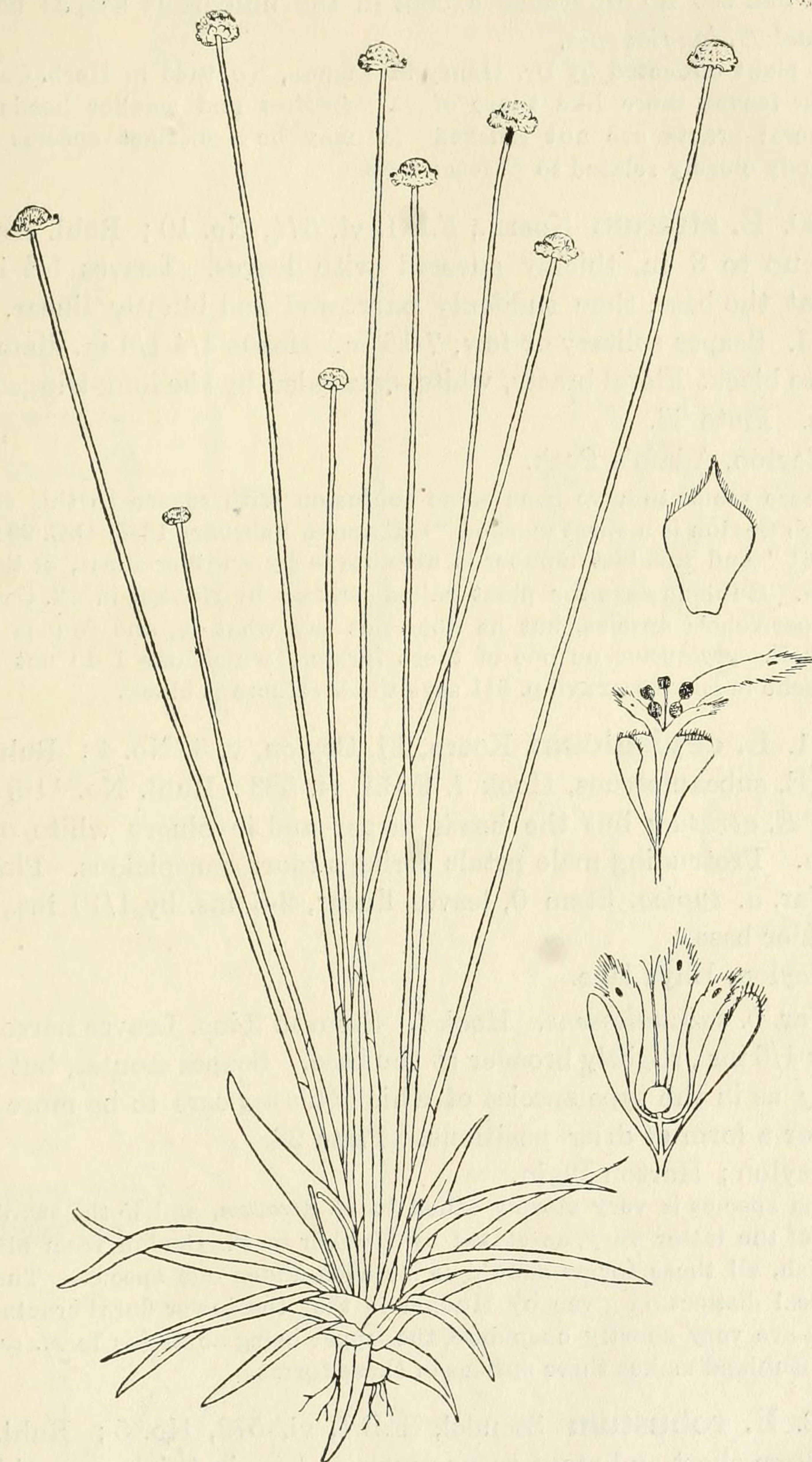
I have seen only two sheets, both in Herb. Calc. One coll. by Hooker and Thomson, has apparently the female sepals 2 only, and black involucre bracts. The other Meebold No. 9889, has the female sepals 3 and the bracts pale. In other respects and especially in the large glands of the female petals they are alike. Hooker in F.B.I. describes the female sepals as longer than the petals.

29. *E. longicuspis* Hook. f. (C.P. 789 in Herb. Ceylon!) F.B.I. vi, 573, No. 7 and 8; Ruhl. p. 116 "incognita."

Stem disciform, leaves usually 3 (2-8) in. Bracts acuminate, fringed with white hairs, and more or less hidden by the projecting male petals the lowest of which form a conspicuous fringe round the head. Flowers regular and normal. Plate 25 and fig. opposite.

Var. *a. typica* scape solitary. Ceylon.

Var. *b. polycephalum*. Hook. f. (Duthie 10,580 in Herb. Calc!) F.B.I. l.c. No. 8. Scapes numerous, otherwise as type.



D. R. Fyson

ERIOCAULON LONGICUSPIS. *Hook. f., var. polycephala.*

Central India, Pachmarchi ; Peninsular India, Mysore, Palghat.

I can see no difference except in the numerous scapes between this and *E. longicuspis*.

A plant collected by Dr. Henry in Yuman, No. 9443 in Herb. Calc. has smaller leaves more like those of *E. odoratum* and smaller heads. The involucre bracts are not reflexed, It may be a distinct species but is obviously closely related to *E. longicuspis*.

30. ***E. atratum*** Koern., F.B.I. vi, 574, No. 10 ; Ruhl. see p. 69 Stem up to 3 in. thickly covered with leaves. Leaves $1/4$ - $1/3$ in. wide at the base, then suddenly narrowed and bluntly linear, many nerved. Scapes solitary or few, 7-15 in. Heads $1/4$ - $1/3$ in. diam. Involucre black. Floral bracts, white, concealed by the long-fringed male petals. Plate 26.

Ceylon, Adam's Peak.

There seems to have been some confusion with regard to this species. In Herb Ceylon is a sheet marked "Galagama February 1846, O.C. 932" and "C.P. 61" and this last number is also borne by another sheet, of the next species. Ruhland says the plant called *atratum* by Hooker in Fl. Ceylon is not Koerniche's species, but he does not say what is, and founds a new species *E. subglaucum* on one of these former, which one I do not know. Koerniche in Linnaea xxvii p. 611 says the involucre is black.

31. ***E. ceylanicum*** Koern, Fl. Ceylon, v, 3, No. 4 ; Ruhl. No. 128 ; (*E. subcaulescens*, Hook f. F.B.I. vi, 583 ; Ruhl. No. 116) Similar to *E. atratum* but the heads larger and involucre white or yellowish. Protruding male petals perhaps more conspicuous. Plate 27.

Var. *a. typica*. Stem 0, leaves linear, 2-6 ins. by $1/10$ ins., from a broader base.

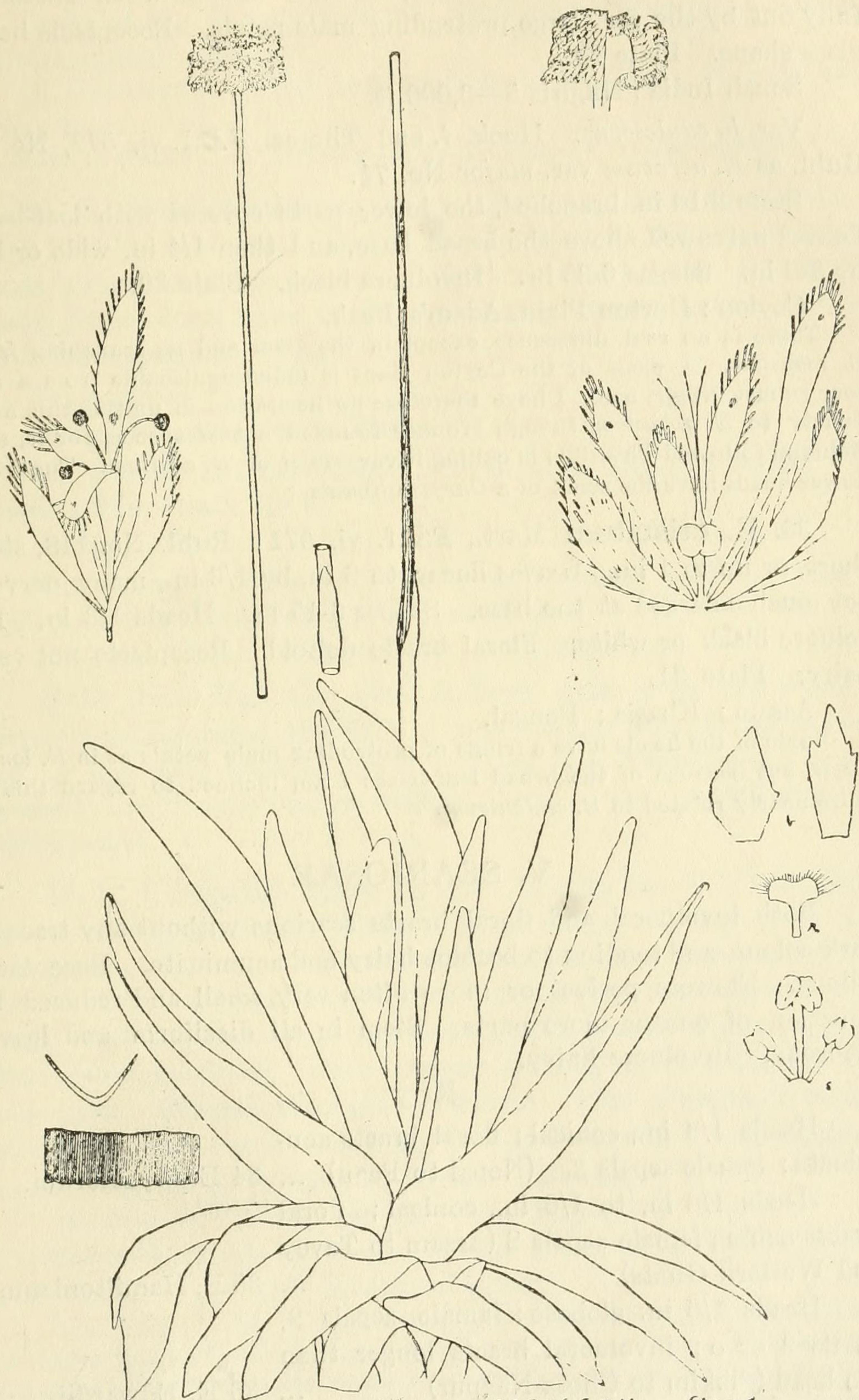
Ceylon, Eliya lake.

Var. *b. subcaulescens*. Hook f. Stem to 2 ins. Leaves narrow 2-4 ins. by $1/6$ ins., slightly broader at the base. Scapes stouter, but heads exactly as in the type species of which this appears to be more developed or a form of drier positions. Plate 28.

Ceylon ; Horton Plain.

This species is very closely allied to *E. atratum*, and if the involucre bracts of the latter vary, as stated by Hooker in Fl. Ceylon from black to yellowish, all these forms should be included under one species. The only other real distinction given by Hooker is that the lower floral bracts of *E. atratum* are very shortly cuspidate, the upper being acute (as in *E. ceylanicum*). Ruhland makes three species of these forms.

32. ***E. robustum*** Steudel, F.B.I. vi, 572, No. 5 ; Ruhl. No. 120. Stem short and stout to as much as 1 in. in thickness: thinner and branched in var. *b*. Ls. up to 12 in. by 2 in., many nerved, glossy, coriaceous. Scapes to 24 in. Heads $1\frac{1}{4}$ in. Involucre white or



R Natesan

ERIOCAULON ROEUSTUM

Steud

gray. Floral bracts acute, ciliate, entirely hidden when these are fully out by the very large protruding male petals. Receptacle hour-glass shape. Plate 29.

South India ; Nilgiris 5—6,000 ft.

Var. *b. caulescens*. Hook. f. and Thoms. F.B.I. vi, 572, No. 5 ; Ruhl. as *E. atratum* var. *major* No. 74.

Stem 3-10 in. branched, the lower parts covered with leaf-bases. Leaves narrowed above the broad base, and then 1/4 in. wide or less by 3-6 in. Scapes 6-25 in. Involucre black. Plate 30.

Ceylon : Horton Plain. Adam's Peak.

There is no real difference except in the stem and its branching from *E. robustum*. A piece of the Ceylon plant is indistinguishable from a not very robust Nilgiri one. I have therefore no hesitation in uniting this as a variety to *E. robustum*, though Hooker founded a new species for it, and Ruhl. followed Thwaites in calling it var. *major* of *E. atratum*. The fresh flower heads have the scent of a *Chrysanthemum*.

33. ***E. cristatum*** Mart., F.B.I. vi, 574 ; Ruhl. No. 118, stem short, or up to 1 in. Leaves linear to 6 in. by 1/6 in., many nerved, not much enlarged at the base. Scapes 6-15 in. Heads 1/3 in. Involucre black or white. Floral bracts deltoid. Receptacle not very hairy. Plate 31.

Assam ; Khasia ; Bengal.

Some of the heads have a fringe of protruding male petals as in *E. longispis*, but because of the broad leaf-bases I am inclined to regard this as more nearly related to *E. ceylanicum*.

V. SEARIOSAE

Both involucre and floral bracts scarious without any trace of dark colour, and tending to become hairy and acuminate. Receptacle villous. Flowers perfect or more often very small and reduced by omission of one or more parts. Stem in all disciform and leaves glabrous. Involucre hairy.

Key

Heads 1/3 in., conical ; floral bracts acuminate ; female sepals 3. (Nepal to Pegu) ... 34 *E. oryzetorum*.

Heads 1/8 in. to 1/6 in., conical ; floral bracts acute ; female sepals 2 (Assam to Tavoy and Western Ghats) ... 35 *E. Hamiltonianum*;

Heads 1/6 in. globose ; female sepals 2, petals 2 or 0 ; involucre bracts longer than the head (Sikkim to Chota Nagpur) ... 36 *E. Edwardii*.

34. ***E. oryzetorum*** Mart. (Wall. Cat. 6069 in Herb. Calc.!) F.B.I. vi, 579, No. 25 in part ; Ruhl. No. 126. Annual (*Mart.*)

Leaves 2-3 in. by $\frac{1}{6}$ in. Sheaths as long. Scapes several, slender 12-17 in. Heads $\frac{1}{3}$ in. Involucral bracts blunt; floral acuminate scabrid. Flowers normal. Plate 32.

C. Himalayas; Nepal and southwards to Chota Nagpur and Burma Pegu.

Mart. in Wall Pl. As. Rar. iii. gives floral bracts as "dorso-barbulatis".

35. **E. Hamiltonianum** Mart.; F.B.I. as *E. oryzetorum* l.c.; Ruhl. No 179. Perennial (*Mart.*) Leaves $1\frac{1}{2}$ - $2\frac{1}{2}$ in. Sheaths shorter, scapes numerous, very slender. Heads conical, $\frac{1}{6}$ in. Involucral bracts, blunt; floral acute, hardly acuminate. Sepals narrow, 2 only; petals 3 oblanceolate. Plate 33.

Var *a typica*.

Assam & southwards to Tavoy.

Var *b minor*. (King at Siliguri 1878 in Herb. Calc.) ; Leaves $\frac{1}{2}$ -1 in. Scapes 1-2 in. Heads $\frac{1}{8}$ in.

Assam; Siliguri.

Var *c minima*, (Meebold 9898!) leaves linear $\frac{1}{2}$ - $1\frac{1}{2}$ in. Scapes capillary 1-4 in. Heads $\frac{1}{8}$ in. Flowers few.

Peninsular India; Western Ghats at Castles Rock.

If the sheet Wall. Cat. 6069 in Herb. Calc. given this name is correctly so numbered, the plant is quite distinct from *E. oryzetorum*, not an immature state as given in F.B.I. l. c. Varieties *a*, *b* and *c* appear to me to grade into each other, though *a* and *c* would certainly seem distinct.

36. **E. Edwardii** Fyson sp. nov. (Clarke No. 34327 in Herb. Calc!) Caulis perbrevis. Folia 2-5 cm. longa, 4-6 mm. basi lata, acuta, glabra, tenuia. Pedunculi 6-20 cm. tenues. Capitula 3-5 mm obconica sed demum globosa, bractae involucrantes nec reflexae, 4 mm. longa, scariosae, glabrae, ellipto-acutae, quam bractis flores superantibus paulo longiores. Haec bractae glabrae, obovato-acutae, pallido-nigrae. Receptaculum altum villosum. Flos ♀ Sepala 2, tenuia; petala 2 linearia, aut. o. Semina 3. Flos ♂ Sepala 2? in spatham connata; petala o. antherae 6, nigrae. Plate 34.

Himalayas: Sikkim; Bengal; Chota Nagpur.

Scapes 3-4 times the leaves. Heads gbose or nearly so, in bud over-topped by the acute involucral bracts.

This species stands in much the same relation to the other two members of this section as *E. minutum* to the first two species of the next section. It represents a corresponding stage in the reduction of the floral parts accompanied by a lengthening of the involucral bracts. It is possible that var. *minor* and *minima* of the previous species should be included in it. The whole series forms a perfect example of gradual reduction in the floral parts.

VI. CRISTATO-SEPALAE

The sepals of the female flowers are deeply boat-shaped with the keel thickened or expanded into a wing or crest, which may be lobed or even pectinate. One sepal may be absent, otherwise the flowers are normal. The floral bracts are glabrous and except in the last two of the series hyaline. The leaves and other vegetative parts are also glabrous. All are marsh or land plants, none grow in running water.

The group appears to have progressed in two directions: perhaps it should really be divided into two sections. One with increasing floral bracts ends in *E. echinulatum* where they have long linear points and the petals are absent; the other with short bracts, developed along the line of decreasing width of the petals, till in *E. sexangulare* they are linear with long hairs. *E. Thomasi*, may be a derivative of this latter species. (See *E. Thwaitesii* No. 14, for similar development.)

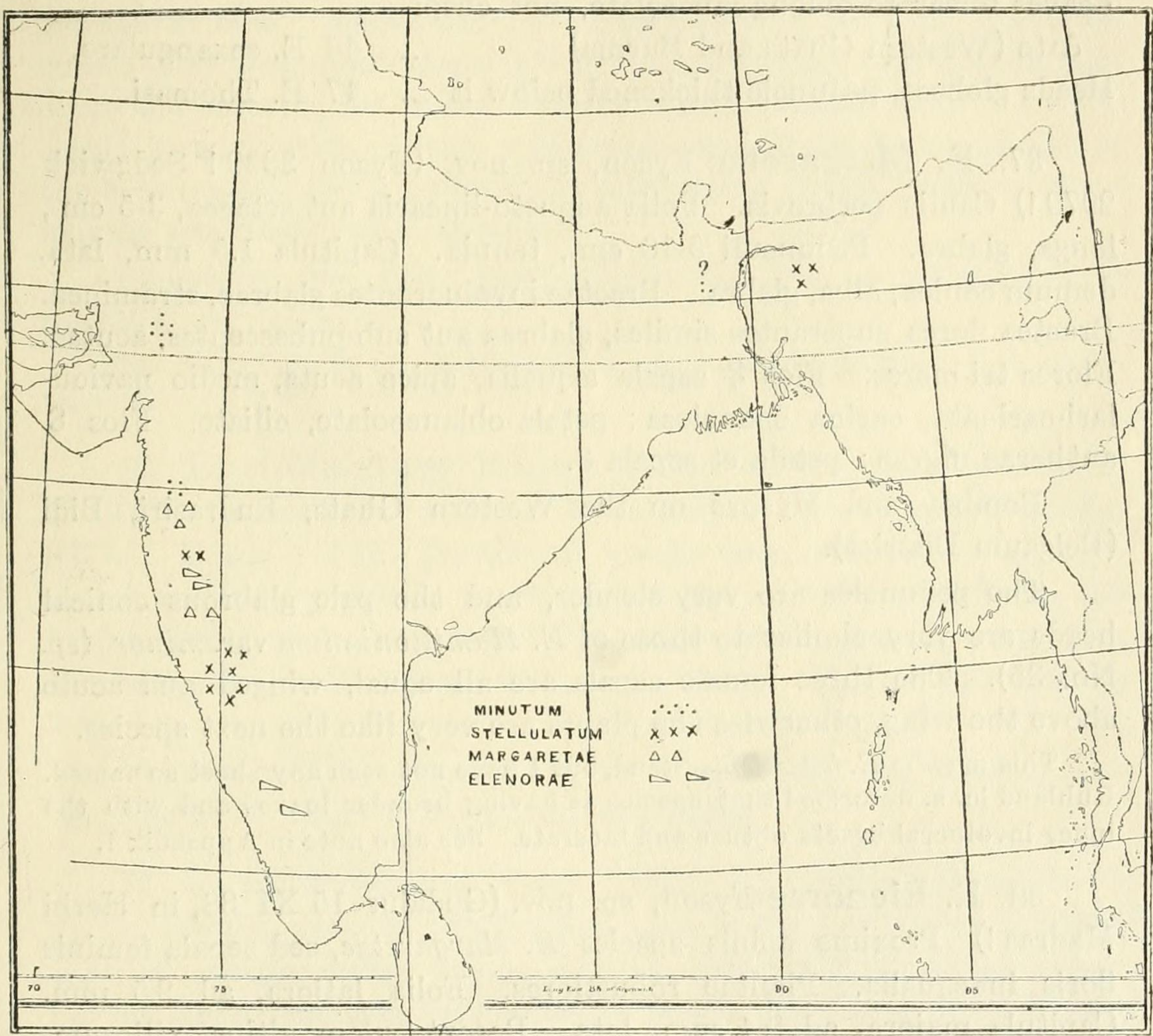
TABLE OF PROBABLE RELATIONSHIPS.

—	E. Margaretæ	... Western Ghats.
	— E. Elenoræ	... Western Ghats.
—	E. minutum	... Western Ghats of Mysore and Mount Abu.
	E. stellulatum	... Western Ghats, Bombay to Malabar.
	E. echinulatum	... Burma to Malay.
—	E. cuspidatum	... Western Ghats.
	E. sexangulare	... Western Ghats, and Burma to Malay.
	E. Thomasi	... S. India.

Key to the Cristato-sepalae.

- * Heads under 1/6 in. diameter. (Mt. Abu to Malabar)
- Heads 1/8 in. conical, female sepals 3, equally crested ... 37 *E. Margaretæ*.
- Heads 1/8 in. conical, female sepals unequal, 1 not crested ... 38 *E. Elenoræ*.
- Heads 1/8 in conical, obconic, the involucre bracts longer than the floral ... 39 *E. minutum*.
- ** Heads 1/6 inch, floral bracts acuminate. (Burma) ... 41 *E. echinulatum*.

CHRISTATO-SEPALAE.



Map 2. Showing the distribution in India of certain species of the section Cristato Sepalae.

*** Heads $1/3$ inch or more.

† Floral bracts much longer than the flowers giving the head a glistening white, echinulate appearance (Western Ghats) ... 40 *E. stellulatum*.

‡ Floral bracts short, closely imbricate, involucre horizontal.

Leaves oblong, with cuspidate apex. (Western Ghats) ... 45 *E. cuspidatum*.

Leaves linear to oblong-lanceolate, not cuspidate (Western Ghats and Burma) ... 46 *E. sexangulare*.

Heads globose, peduncle thickened below it ... 47 *E. Thomasi*.

✓ 37. *E. Margaretæ* Fyson, sp. nov. (Fyson 3839! Sedgwick 2979!) Caulis perbrevis. Folia angusto-lineararia aut setacea, 3-5 cm., longa, glabra. Pedunculi 5-10 cm., tenuia. Capitula 1.5 mm, lata, demum conica, alba, glabra. Bractæ involucrantēs glabrae, straminea. Bractea flores superantes similes, glabrae aut sub-pubescentes, acutae. Flores tri-meres. Flos ♀ sepala æqualia, apice acuta, medio naviculari-carinata, carina spongiosa; petala oblanceolate, ciliate. Flos ♂ antherae nigrae; petala et sepala 3.

Bombay and Mysore on the Western Ghats, Rudrasiri, Bidi (Belgaum District).

The peduncles are very slender, and the pale glabrous conical heads are very similar to those of *E. Hamiltonianum* var. *minor* (sp. No. 35). The three female sepals are all equal, winged and acute above the wing, otherwise the plants are very like the next species.

This may be *E. heterolepis*: Steud, but I have not seen any sheet so named. Ruhland l.c. s. described that species as having broader leaves and with the inner involucre bracts obtuse and lacerate. See also note in Appendix I.

✓ 38. *E. Elenoræ* Fyson, sp. nov. (Gudalur 15 XI 88, in Herbi Madras!) Proxime affinis species *E. Margaretæ*, sed sepala feminis floris inaequalia. Plantae robustiores. Folia latiora, ad 2.5 mm. Capitula majora, ad 3-4 mm. lata. Receptaculum altius, villosum. Bractæ involucrantēs acutae aut cuspidatae. Sepala floris ♀ inaequalia, primum et secundum carinata; tertium paulum brevius, valde angustius, ecarinatum. Flos ♂ antherae nigrae, petala et sepala 3. Plate 35.

Peninsular India; on the Western Ghats at Mahabaleshwar, Castle Rock, etc., Gudalur.

Leaves 1-3 in. by $1/16$ - $1/10$ in. at the middle, 5 or 6-nerved. Scapes numerous, variable in height 2-5 in., glabrous 4 or 5-ribbed. Involucre bracts elliptic-acute, at first horizontal later reflexed.

Floral similar, slightly acuminate, sparingly pubescent. Receptacle tall, hairy. Female sepals 3 unequal, one much the largest, the smallest not crested.

These last two species are very closely connected and might perhaps be considered one species, but *E. Elenorae* seems to be always the robust, and in *E. Margaretæ* I have never found the female sepals at all unequal.

39. ***E. minutum*** Hook. f.; F.B.I. vi, 579, No. 28; Ruhl. No. 190. Whole plant very small. Leaves linear $1\frac{1}{2}$ - $3\frac{1}{4}$ in. long, from a broad 3-5 nerved base. Scapes numerous, very slender $1\frac{1}{2}$ - $2\frac{1}{2}$ in. Head obconic, the involucral bracts $\frac{1}{8}$ in. long-glabrous, scarious, elliptic-acute and covering the floral. Floral bracts oblong, acute. Female sepals 2 only, narrow, with a pectinate crest along the upper half of the back; petals 0. Male flowers normal, petals small. Seeds oblong elliptic, reddish brown. Plate 36.

Rajputana; Mt. Abu: Peninsular India; Mysore and Kanara on the Western Ghats.

This species might be mistaken for a small and meagre form of *E. xeranthemum*.

40. ***E. stellulatum*** Koern.; F.B.I. vi, 579, No. 26; Ruhl. No. 153. Leaves broad and thin 2-3 in. acute. Scapes several slender 3-6 in. Heads $\frac{1}{3}$ in. Involucral bracts lanceolate-acute, reflexed. Floral similar, spreading, much longer than the flowers, making the head a glistening stellate globe. Female sepals 2, strongly crested on the back; petals 3, oblanceolate, very hairy. Male flower normal, 3-merous.

Bombay and Malabar; on the Western Ghats. Abundant on the lake side at Mahabaleshwar in Oct. (*Sedgwick*).

41. ***E. echinulatum*** Mart. (Wall Cat. 6082 in Herb. Calc!) F.B.I. vi, 579, No. 26; Ruhl. No. 177. Leaves acute or aculeate, $1\frac{1}{2}$ -3 in. Scapes many, 3-6 in., slender. Heads $\frac{1}{6}$ in. globose except for the horizontal base, very echinate by the acuminate floral bracts. Female sepals 2 only, winged down the back; petals 0. Male flowers normal, 3-merous. Plate 37.

Burma; Kelaben, Tavoy.

42. ***E. cuspidatum*** Dalz. (Dalziel No. 138 in Herb. Calc!) F.B.I. vi, 581, No. 31; Ruhl. No. 168. Stem disciform. Leaves 1-4 in. by $\frac{1}{6}$ - $\frac{1}{4}$ in. exactly oblong up to the round and apiculate or cuspidate apex above 7 nerved. Scapes several 8-15 in. Heads $\frac{1}{4}$ in. diam., globose, white. Floral bracts cuneate, obovate, hairy. Sepals of both sexes 2 only (F.B.I. has "3, one flat") female sepals deeply

boatshaped and enlarged down the back. Seeds oblong, quite smooth. Petals 3, linear-lanceolate, unequal. Plate 38.

Peninsular India; N. Mysore; Kanara, at sea-level, Malabar, and Concan.

The leaves make this a very distinct species.

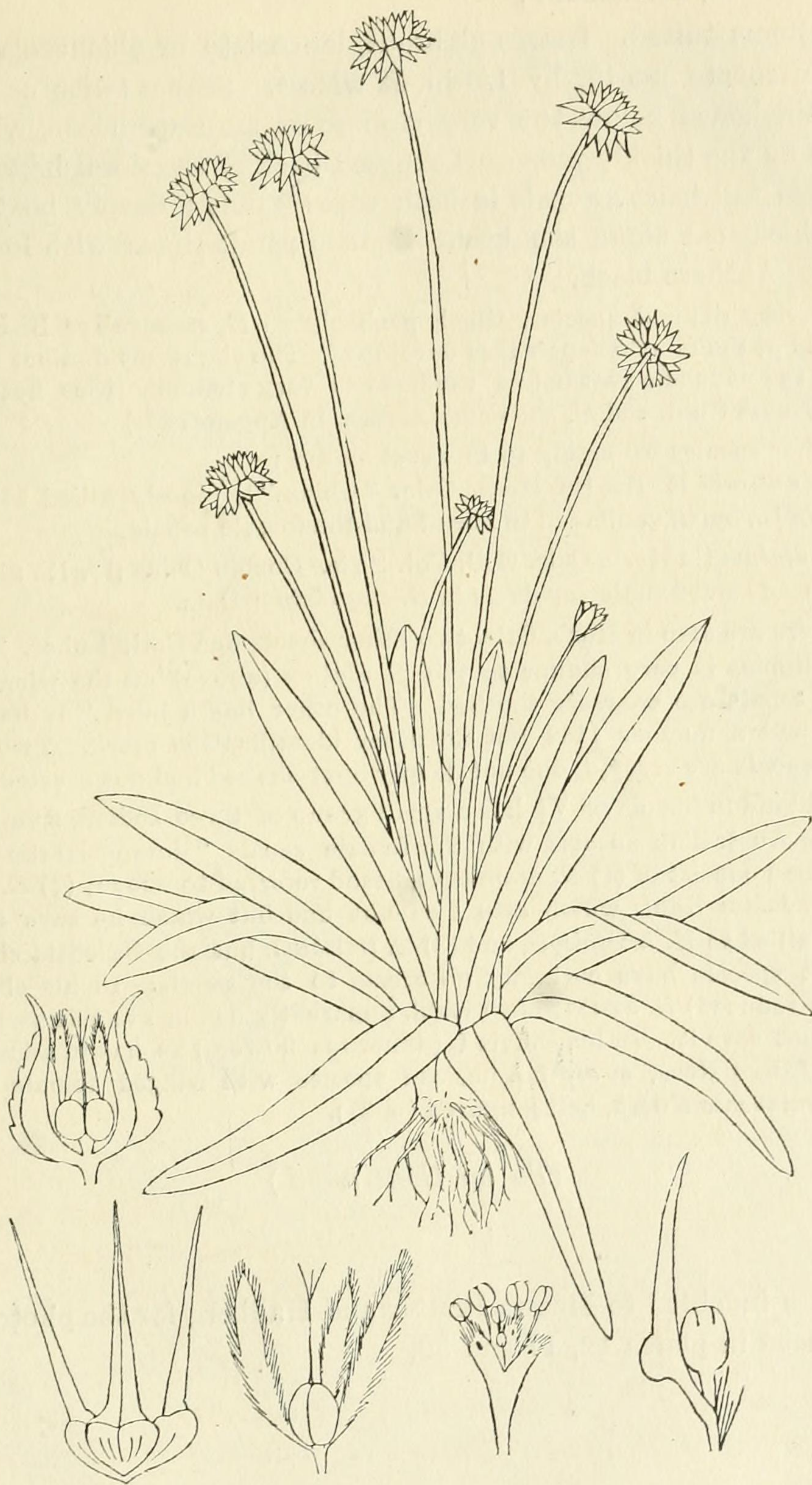
Var. *bracteata*, (Talbot. No. 639 in Herb. Calc!) Involucral bracts longer than the head.

43. *E. sexangulare* Linn. (Wall. Cat. 6068 in Herb. Calc!); F.B.I. vi, 580, No. 29; Ruhl. No. 186, and *E. longifolium* Nees., Ruhl. No. 25; Stem 0. Leaves $1/8$ to $3/4$ in. wide by 4-12 in., many ribbed, flat. Scapes many up to 18 in., stiff. Heads $1/3$ in. or less, hemispherical or conical with eventually a truncate base. Involucral bracts pale, shining. Floral bracts broadly obovate, cuspidate. Flowers 3-merous or 2-merous. Female sepals two very boat-shaped, one flat or absent. Petal linear, with long hairs springing from its base, the whole forming a brush of slender filaments. Seeds flat ovate or subglobose with parallel darker lines, and covered with peltate hairs. Plates 39 and 40.

On the western side of South India down to Ceylon, and throughout Burma and the Malay Peninsula.

The plants of the Western peninsula are larger on the whole than those of the Eastern, which are frequently 2-merous. In the F.B.I. the latter is given as a variety and perhaps it should be so considered, but in every other respect the two forms are identical and it would always be necessary to dissect the heads to determine the point. The Mysore plants connect them. For this reason the separation of these forms as two distinct species, *E. sexangulare* L. & *E. longifolium* Nees, widely apart in different sections of the genus as is done by Ruhland seems particularly unhappy. Koerniche though he separated the American 2-merous species, placed these two together observing that the 2-merous flowers and acute not shortly acuminate floral bracts distinguish them.

44. *E. Thomasi*. Fyson sp. nov. (Meebold 9104 et 9899 in Herb. Calc!) Habitu specii *E. Thwaitesii* Hook. f. similis, sed capitulum globosum, involucri reflexum, sepala duo. Caulis per-brevis. Folia caespitosa, lanceolata acuta, mucronata, glabra, 5-10 cm. longa, 0.4 to 1.0 cm. lata. Pedunculi paulo ad duplice longiores, glabri; sub-capitulo paulo crassi. Capitula globosa. Bractae involucrantae brevae, reflexae. Bractae flores superantes rhomboidocuneata summodorse puberulae. Flos. ♀ sepala 2, naviculari-concava; petala 3, angustissima linearia, longis pilosis barbata magnis glandulis instructa. Semina, oblonga, fusca. Flos ♂ sepala 2, angusta; petala 3; antherae nigrae. Plate 41.



ERIOCAULON STELLULATUM *Koern.*

Peninsular India; on the Western Ghats, Salsette, Khandala, Castle Rock, Tirthahalli!

Stems tufted. Leaves glabrous, lanceolate or oblanceolate acute or mucronate. 2-5 in. by $\frac{1}{3}$ in. at widest. Scapes twice as high or less, thickened below the very globose or truncate heads, which are white by the thickly puberous exposed back of the floral bracts. Receptacle tall hairy. Sepals in both sexes 2 only; deeply boat-shaped and thickened along the keel. Female petals linear with long basal hairs. Anthers black.

A very distinct species, allied probably to *E. sexangulare* L. but with the keel of the female sepals less developed. The slight but distinct thickening of the peduncle just below the head is very striking. (See notes on *E. bombayanum* Ruhl. and *E. neesianum* Koern. in Appendix I.)

Other species belonging to this section are:—

E. australe R. Br. (in Herb. Calc. "China"!) closely allied to *E. sexangulare* L., being similar in the head and the female sepals.

E. alatum (in Herb. Calc. Coll. Col. Pirie. Cochin China;) with glistening ovoid heads and female sepals as in *E. cuspidatum* Dalz.

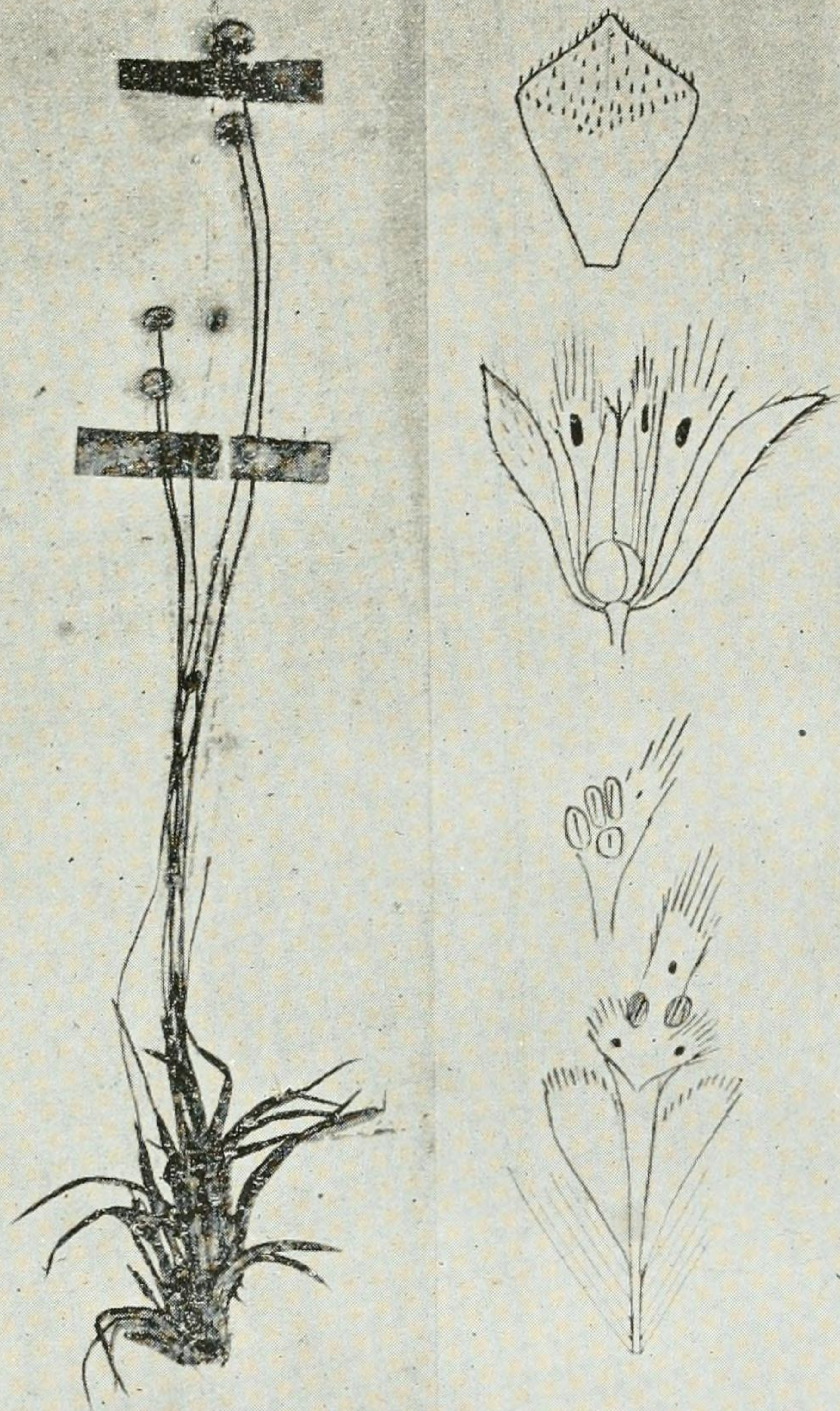
There are also in Herb. Calc. two other sheets one Coll. Loher. No. 1602 in Phillipines is very similar to the *E. alatum* (above) but the wings of the female sepals are coarsely toothed. The other has a label "ex herb hort. Kew" and a number 1168, but no other identification mark. Two of the female sepals are crested, one not deeply boat-shaped and not crested.

Ruhland in his clavis VI has a small group of three Indian, five African and one Australian species with the female sepals "dorsocristatæ-alatæ." The Indian consist of (1) *E. heterolepis*, Steud referred to above, (2) *E. pseudequinquangulare* Ruhl. which also I cannot find but which he says is very closely allied to *E. heterolepis*, and (3) *E. trilobum*, but the Calcutta sheets of this last species have certainly no crests to the sepals. In his clavis V. (flowers reduced) *E. bombayanum* Ruhl. apparently belongs to this series, but I have not seen it. In his Clavis I, (dimerous flowers) he has in addition to *E. longifolium* Nees, several American species with winged female sepals, one *E. guianense* Koern, being figured (p. 37).

(To be Continued.)

I am indebted to Messrs Blatter and Hallberg for the photograph reproduced in plates 12, 17 and 39.

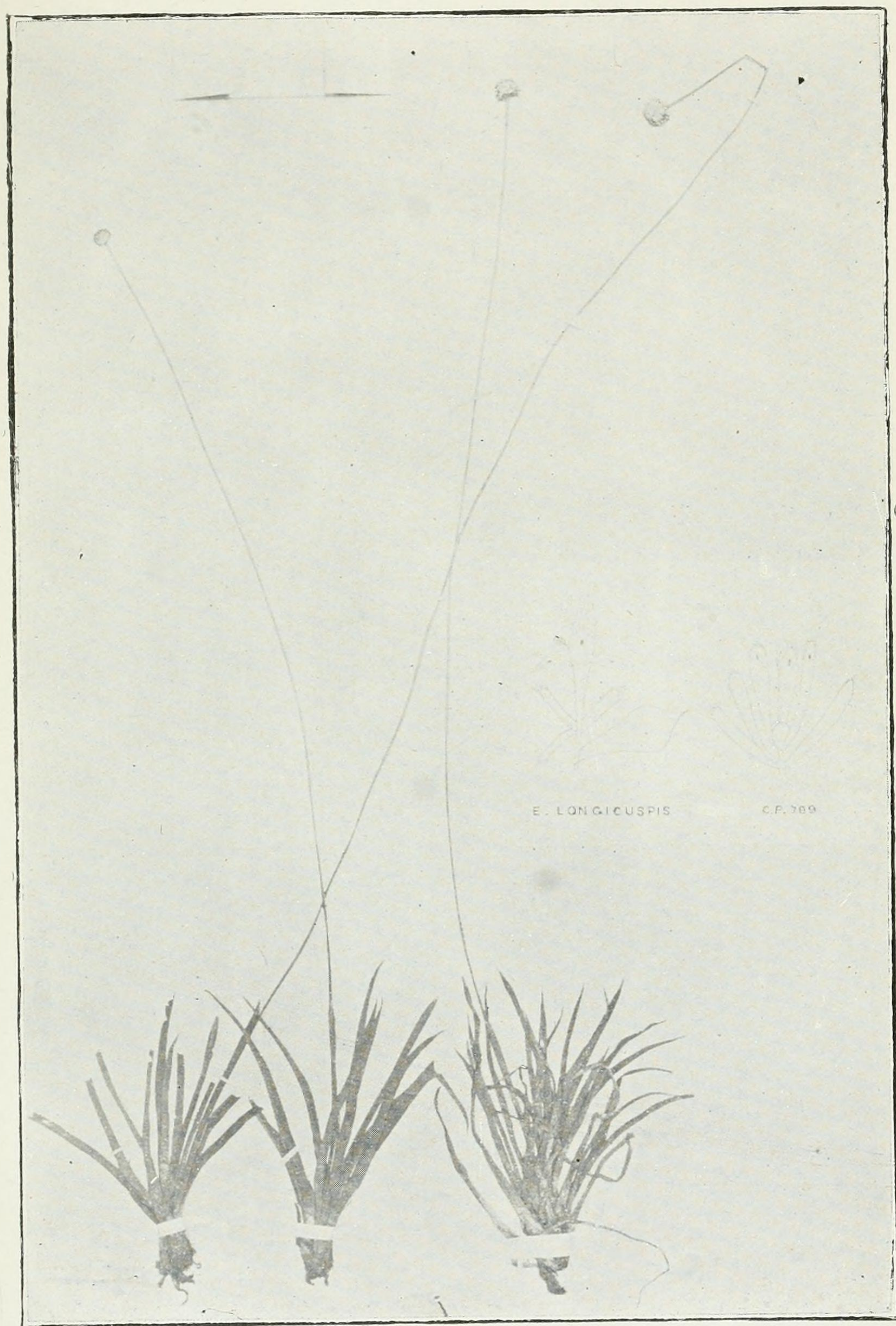
INDIAN SPECIES OF ERIOCAULON, PL 24.



Herb. Ind. C. Hook. fil. & Thomson.
Erioc. odoratum, Dalz.
 Herb. Malabar. Cochin. &c. Regis. Prop.
 1841 Coll. Hook. & Thoms.

ERIOCAULON ODORATUM Dalz.
 (2 sepals only shown of female flower).

INDIAN SPECIES OF ERIOCAULON, PL. 25.



ERIOCAULON LONGICUSPIS Hook. f.

INDIAN SPECIES OF ERIOCAULON, PL. 26.

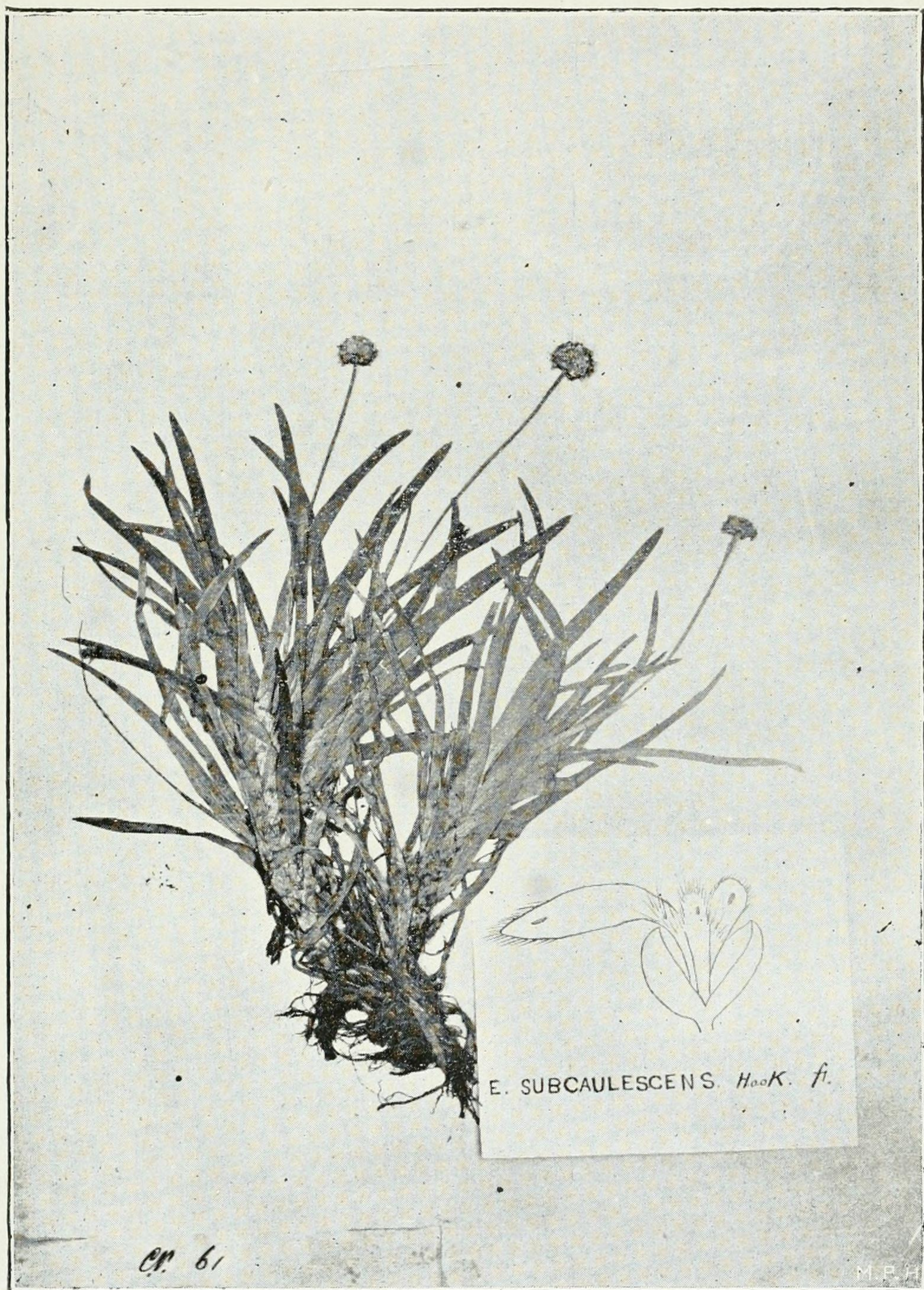


ERIOCAULON ATRATUM Koern.

INDIAN SPECIES OF ERIOCAULON, PL. 27.

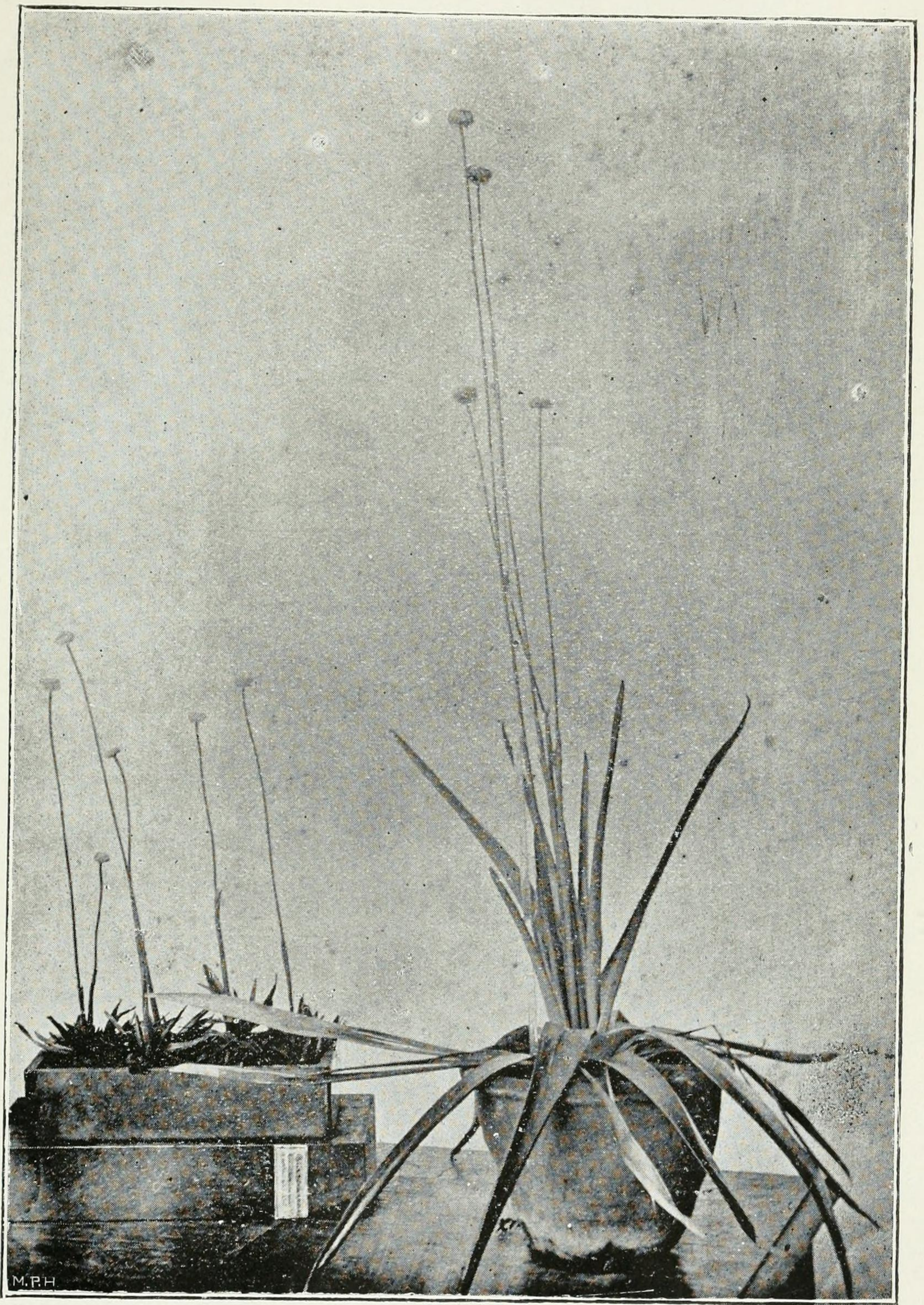


ERIOCAULON CEYLANICUM Koern.

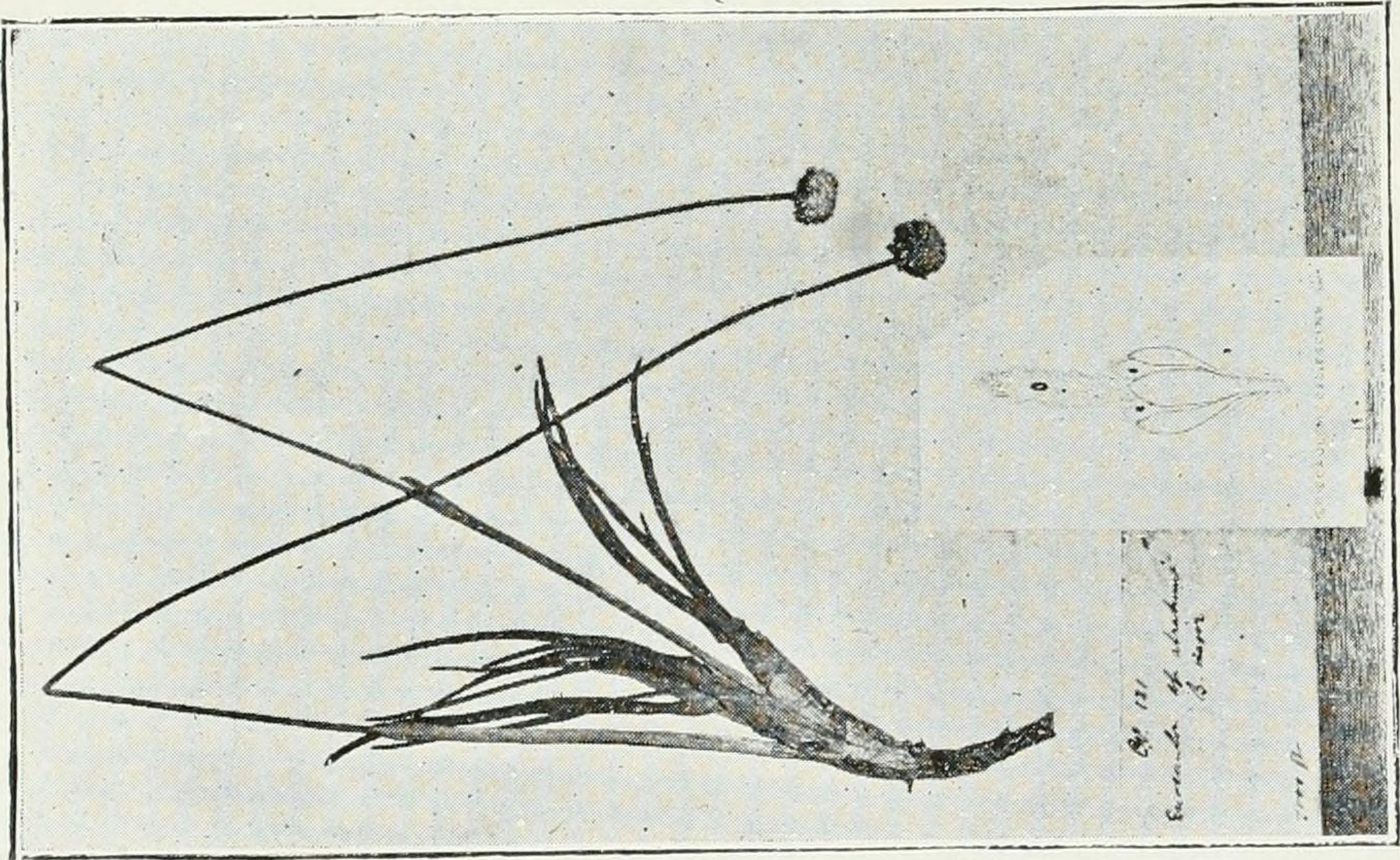
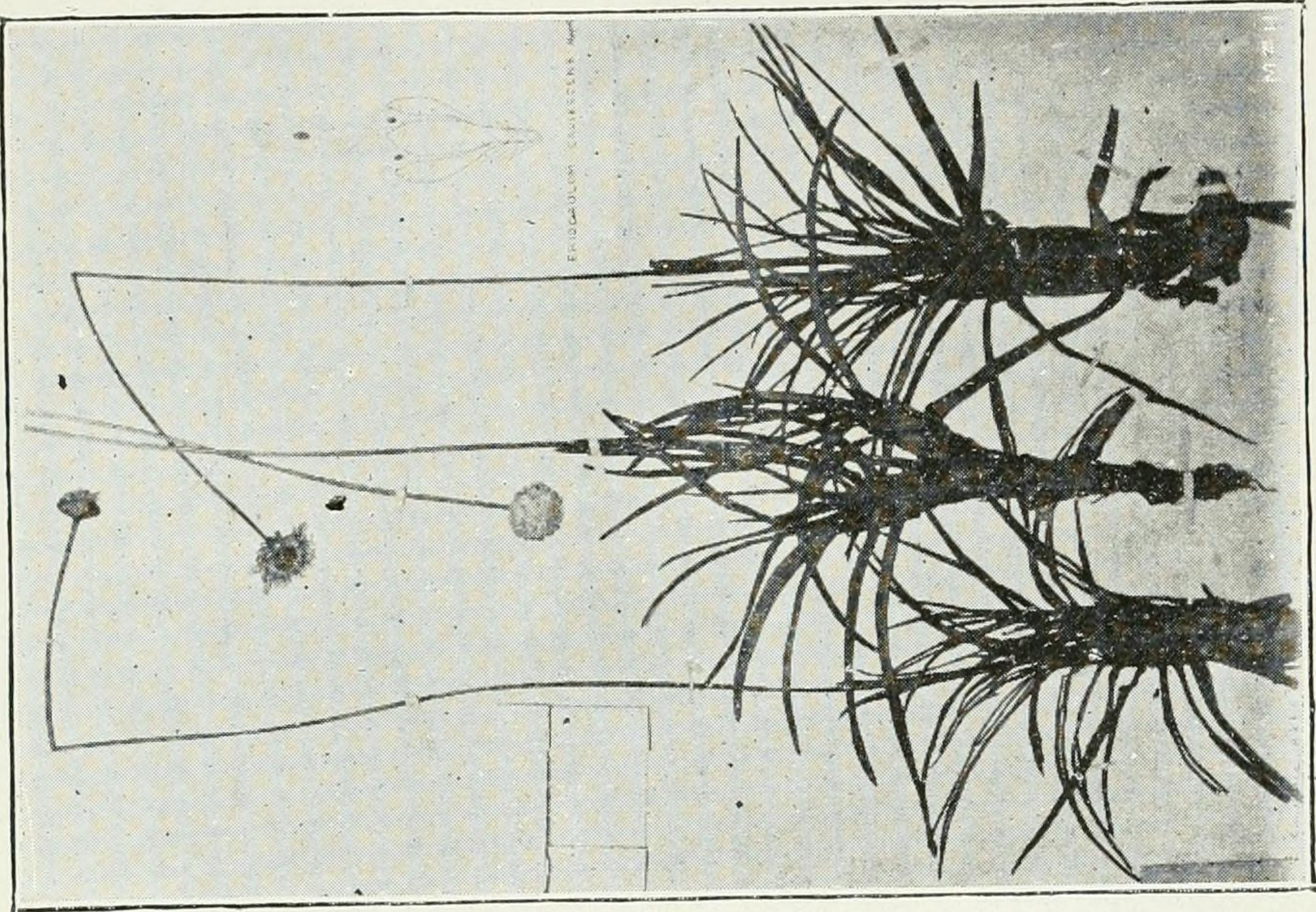


ERIOCAULON CEYLANICUM Koern.
Var. *subcaulescens*.

INDIAN SPECIES OF ERIOCAULON, PL. 29.

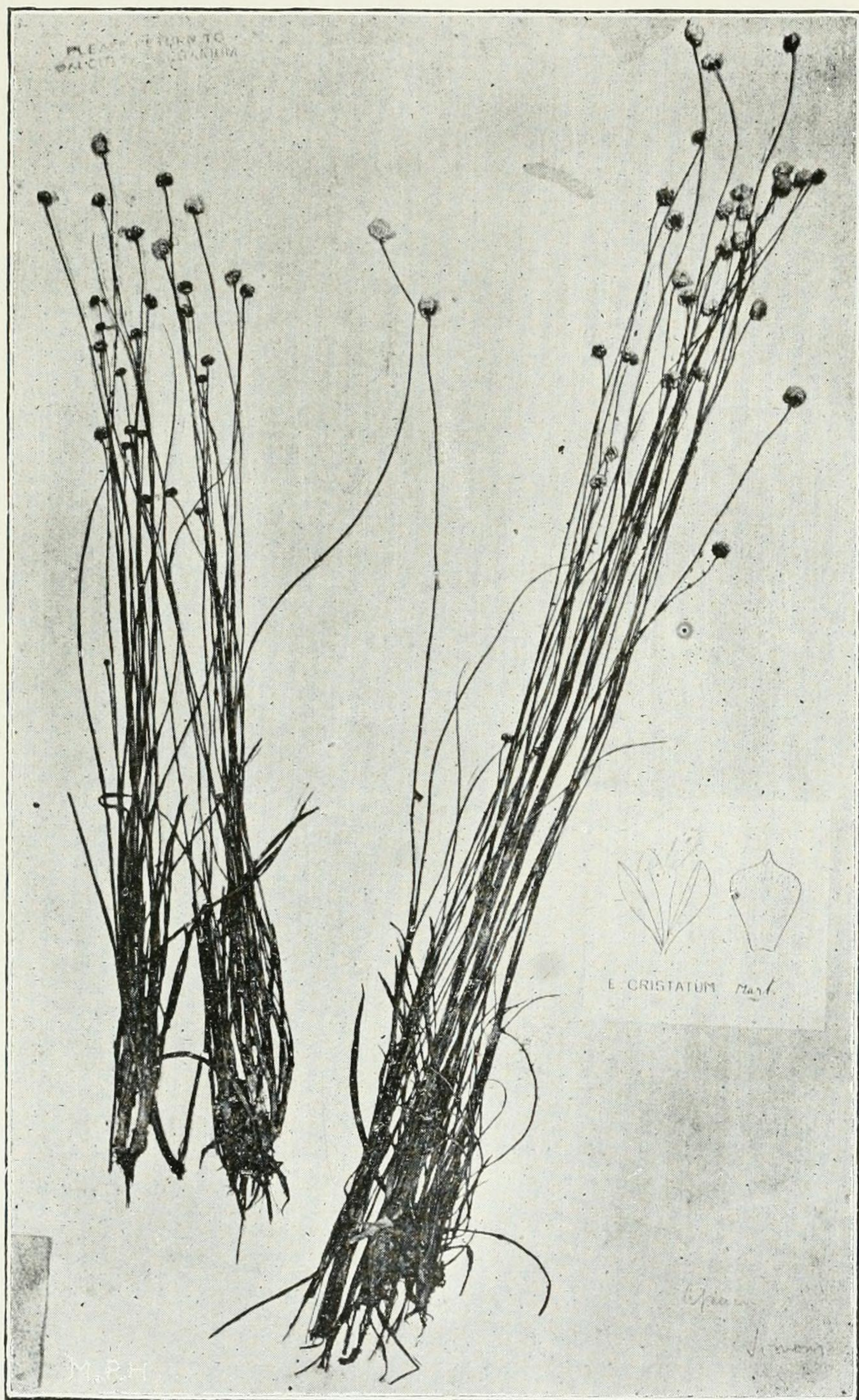


ERIOCAULON ROBUSTUM *Steudel*.
(The right hand plant was 30 inches high).



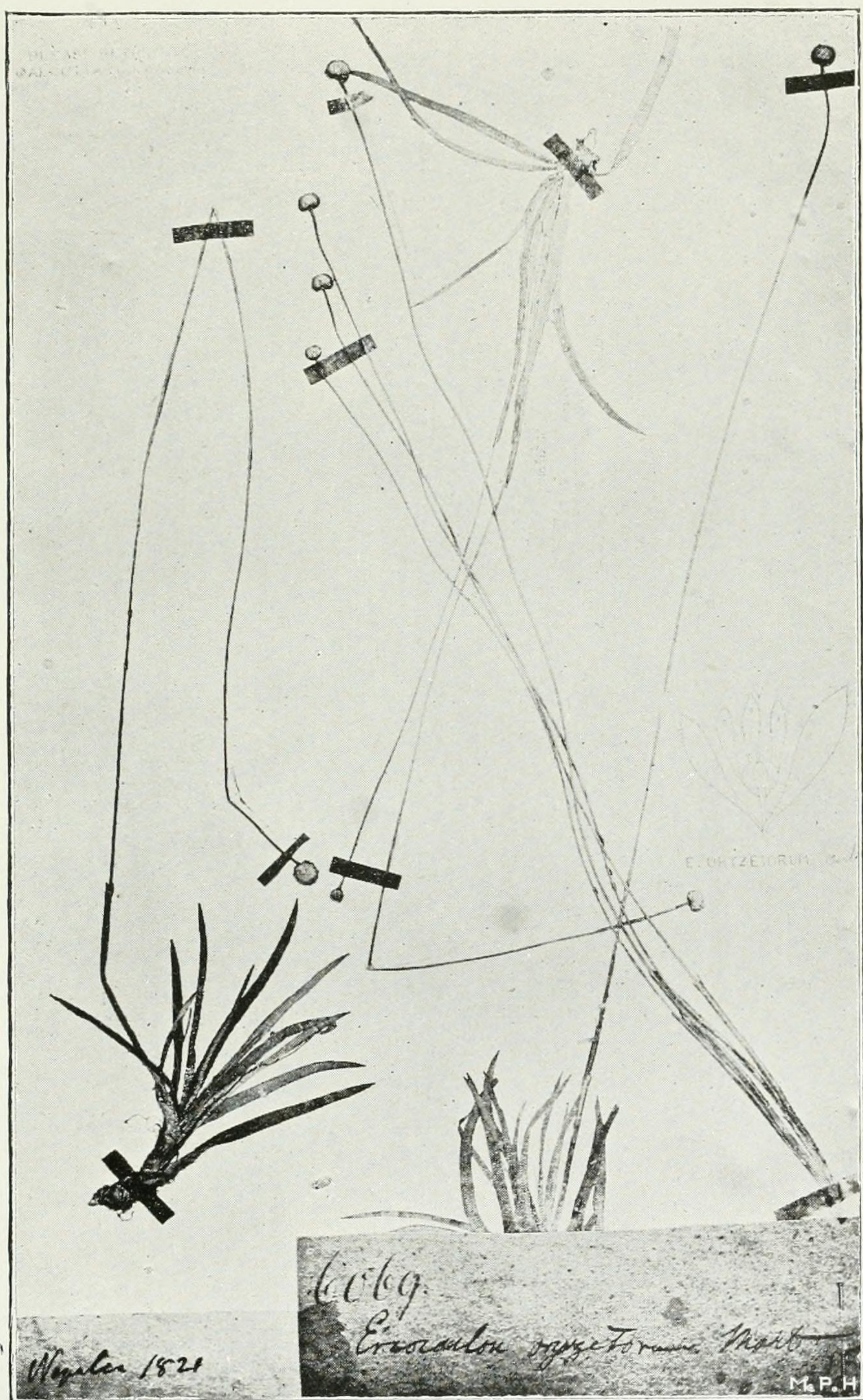
ERIOCAULON ROBUSTUM Steud. Var. caulescens.

INDIAN SPECIES OF ERIOCAULON, PL. 31.



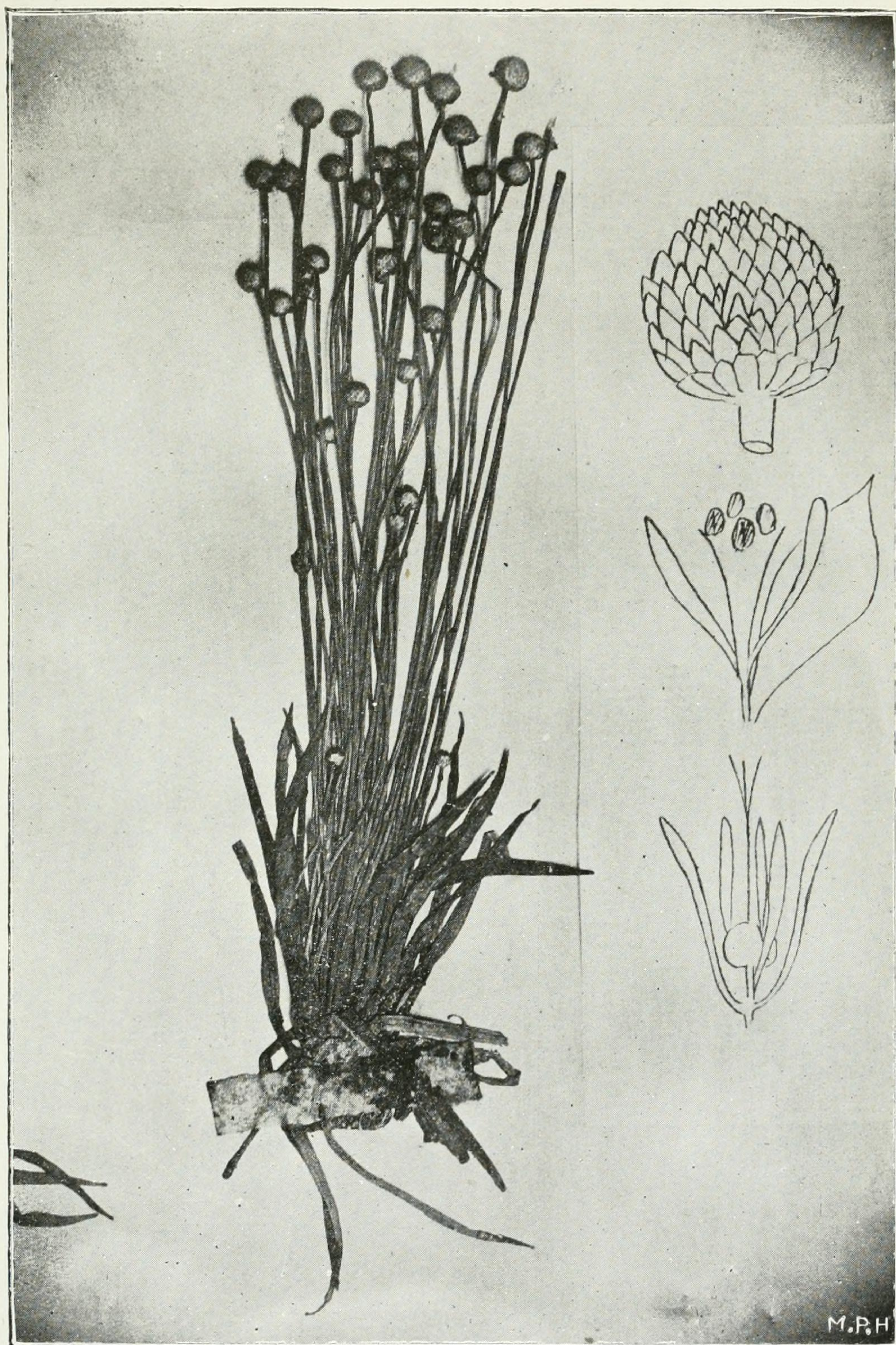
ERIOCAULON CRISTATUM Mart.

INDIAN SPECIES OF ERIOCAULON, PL. 32.



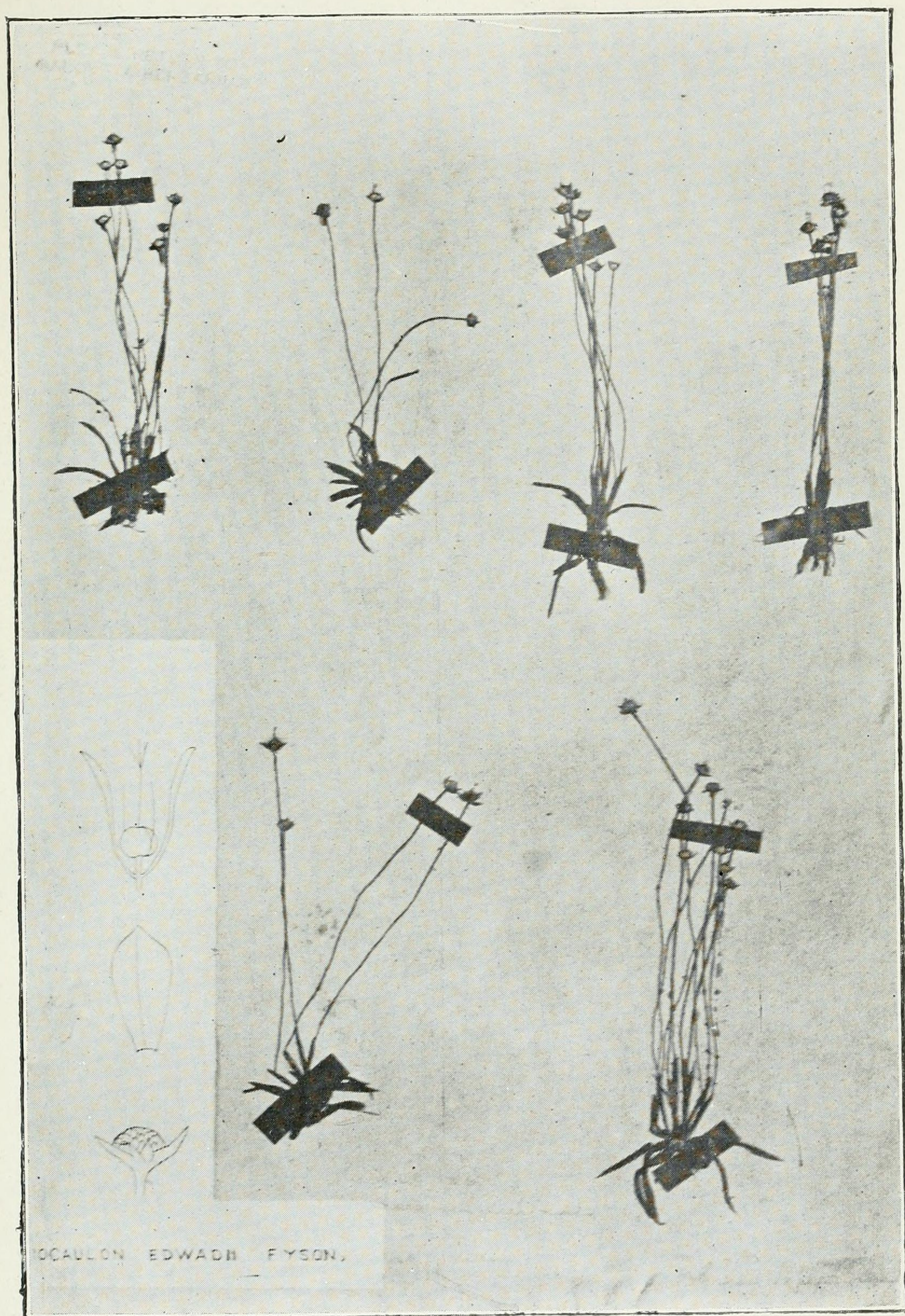
ERIOCAULON ORYZETORUM Mart.

INDIAN SPECIES OF ERIOCAULON, PL. 33.



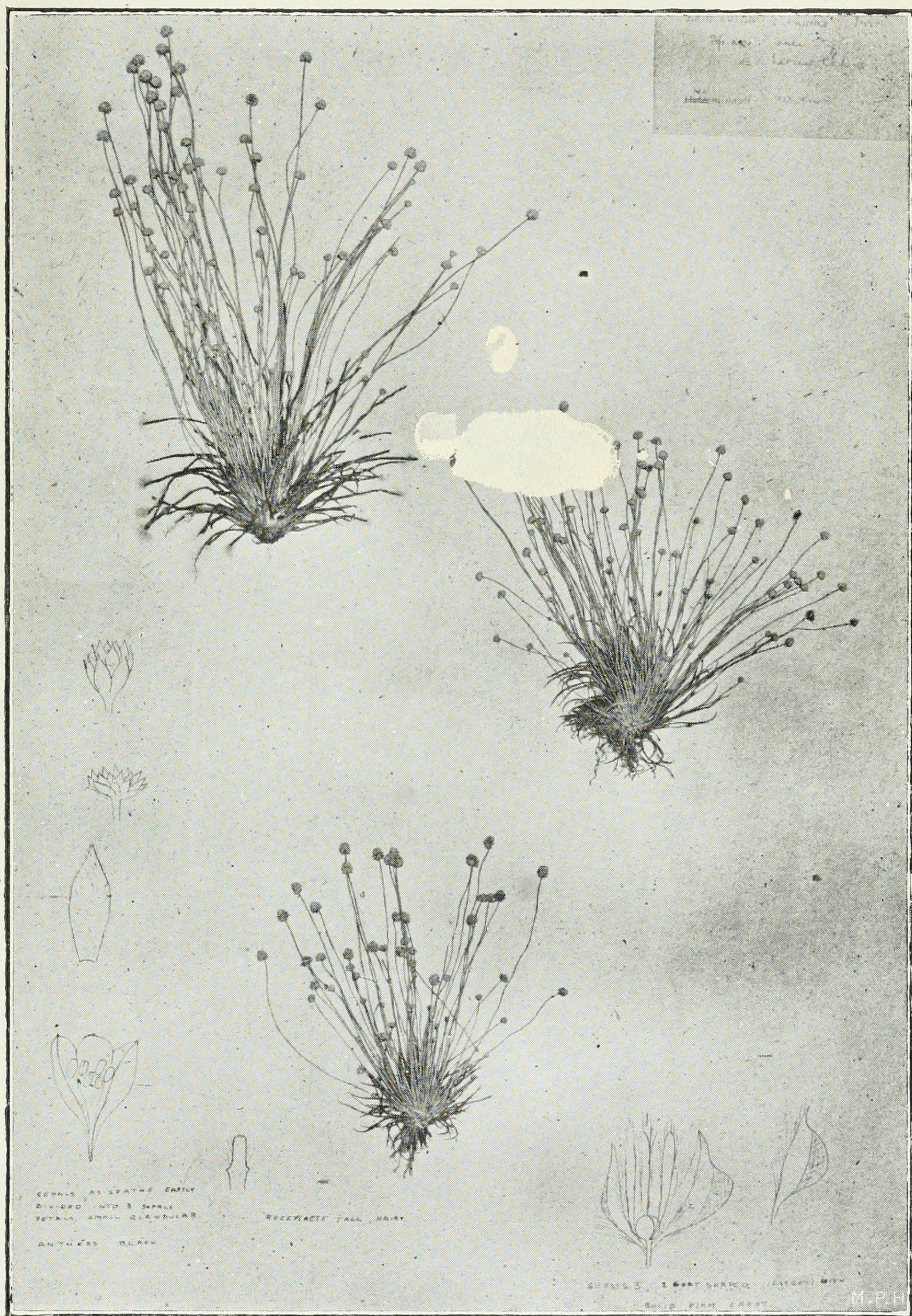
ERIOCAULON HAMILTONIANUM *Mart.*

INDIAN SPECIES OF ERIOCAULON, PL. 34.



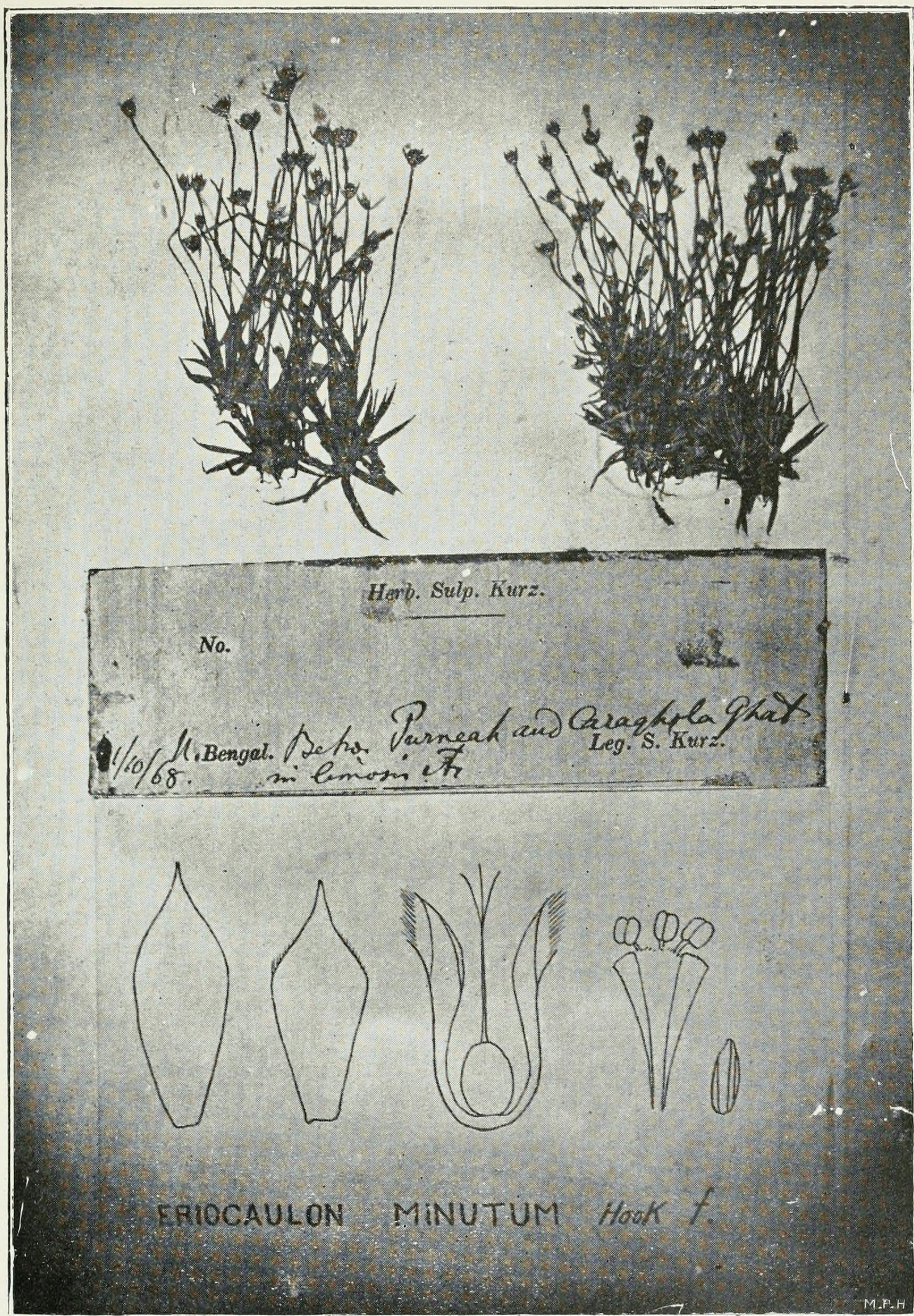
ERIOCAULON EDWARDII *Fyson.*

INDIAN SPECIES OF ERIOCAULON, PL. 35.



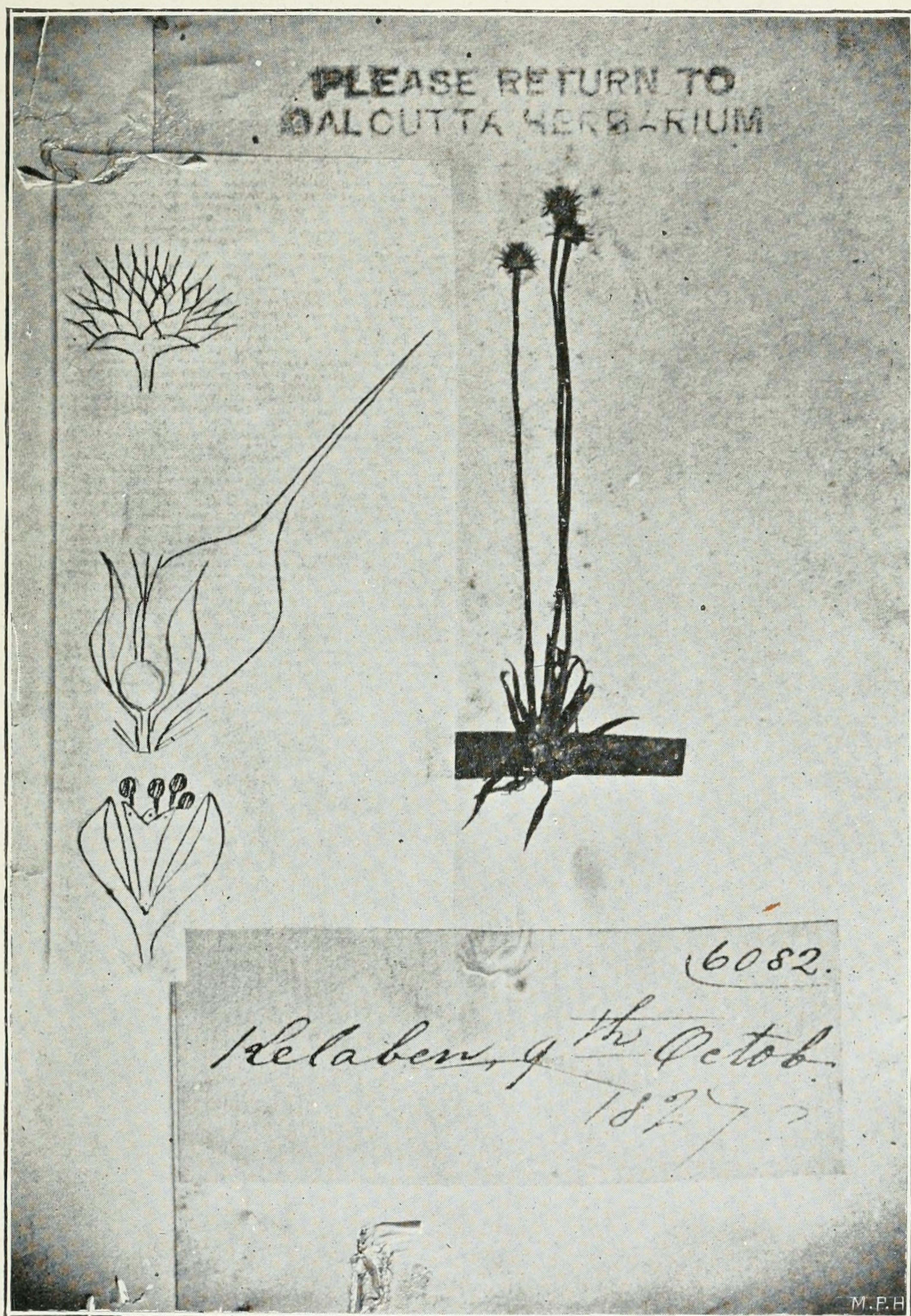
ERIOCAULON ELENORAE *Fyson.*

INDIAN SPECIES OF ERIOCAULON, Pl. 36.

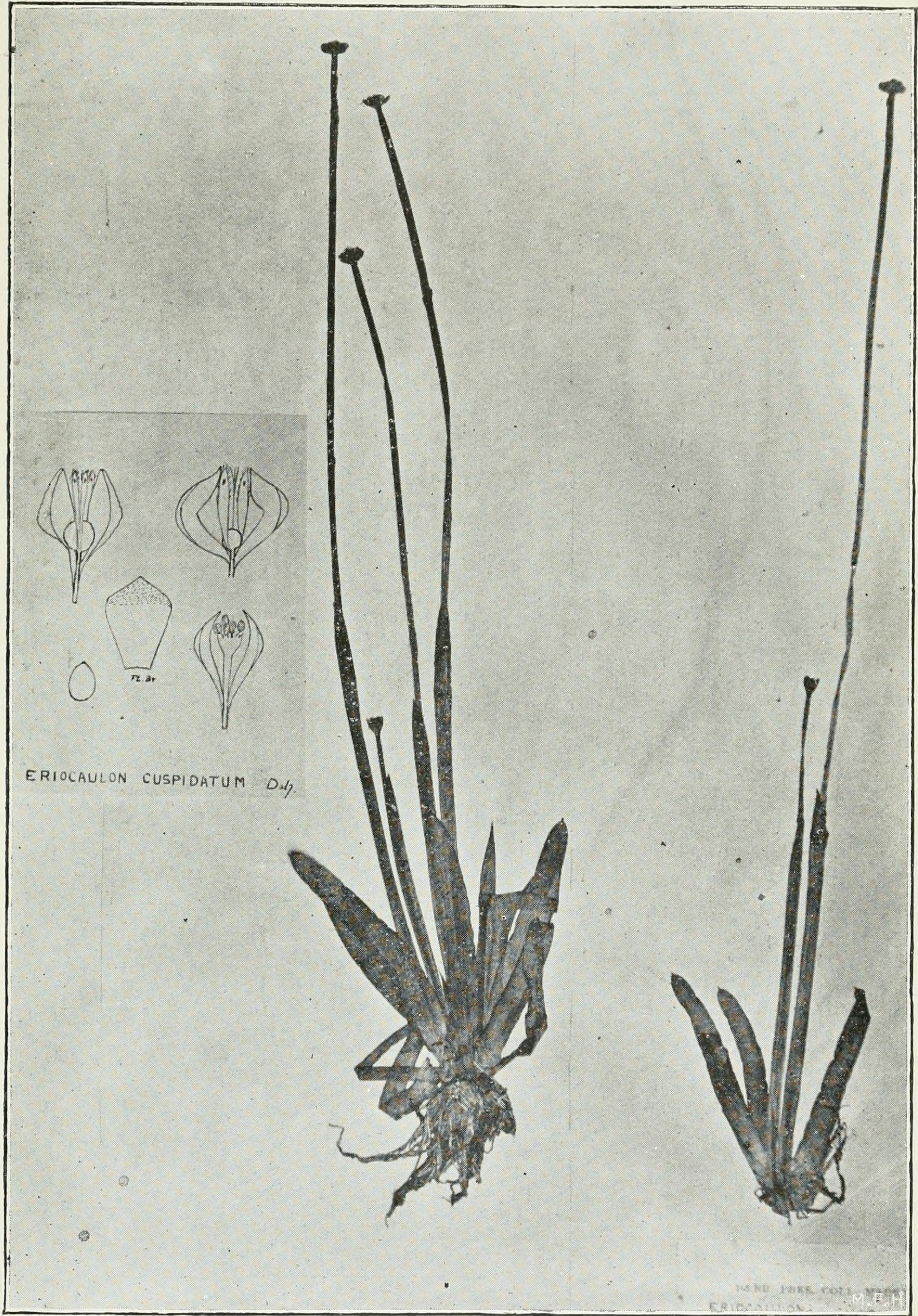


ERIOCAULON MINUTUM Hook.

INDIAN SPECIES OF ERIOCAULON, PL. 37.

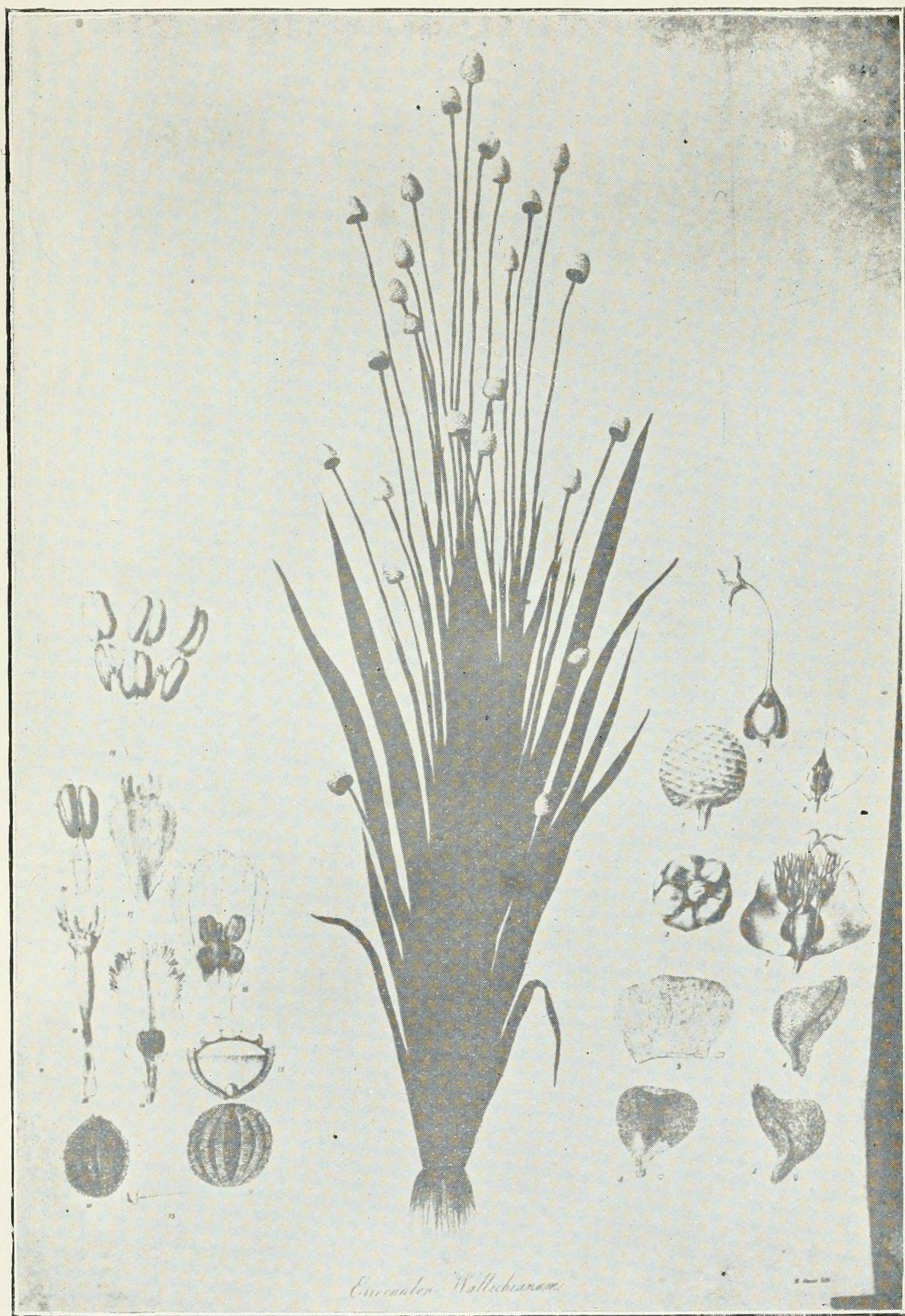


ERIOCAULON ECHINULATUM Mart.



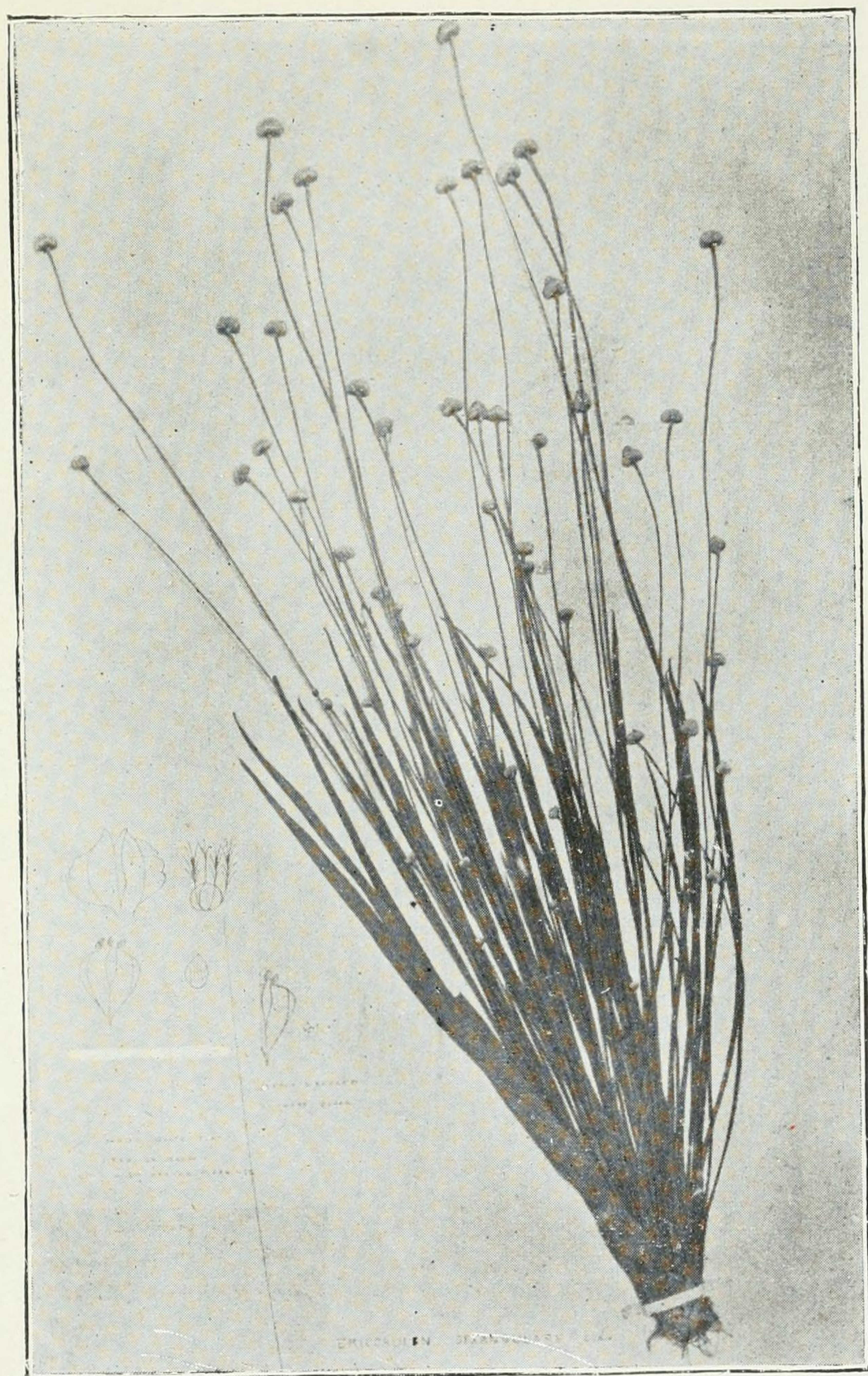
ERIOCAULON CUSPIDATUM Dalz.

INDIAN SPECIES OF ERIOCAULON, PL. 39.



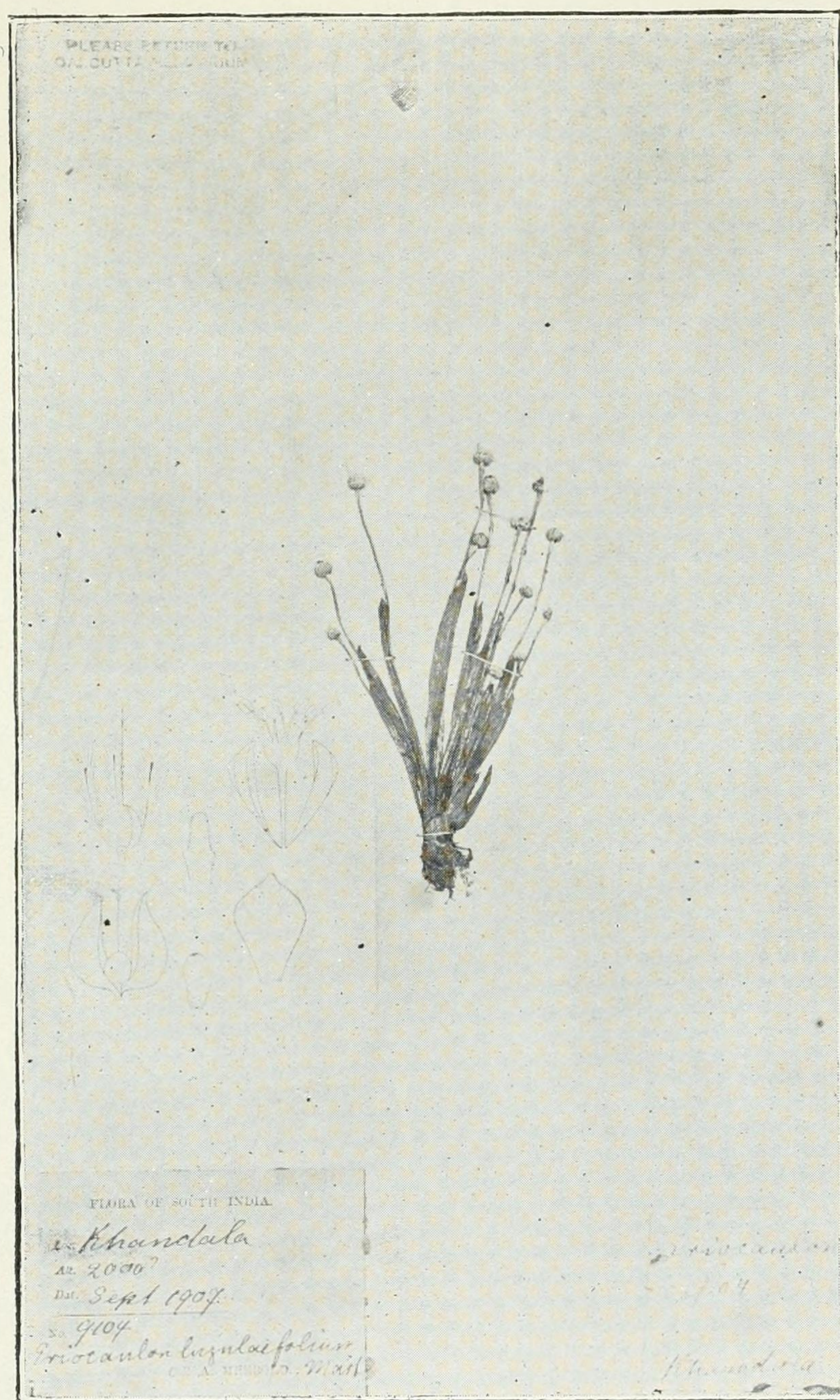
ERICCAULON SEXANGULARE *Linn.*
(From photo of figure in Wall. Pl. As. Rar. iii. t. 242.)

INDIAN SPECIES OF ERIOCAULON, PL. 40.



ERIOCAULON SEXANGULARE *Linn*

INDIAN SPECIES OF ERIOCAULON, PL. 41.



ERIOCAULON THOMASI *Fyson.*